FEBRUARY 1958

Who says we're running out of water?
page 9

Help your company save tax dollars
page 16

# POWER INDUSTRY

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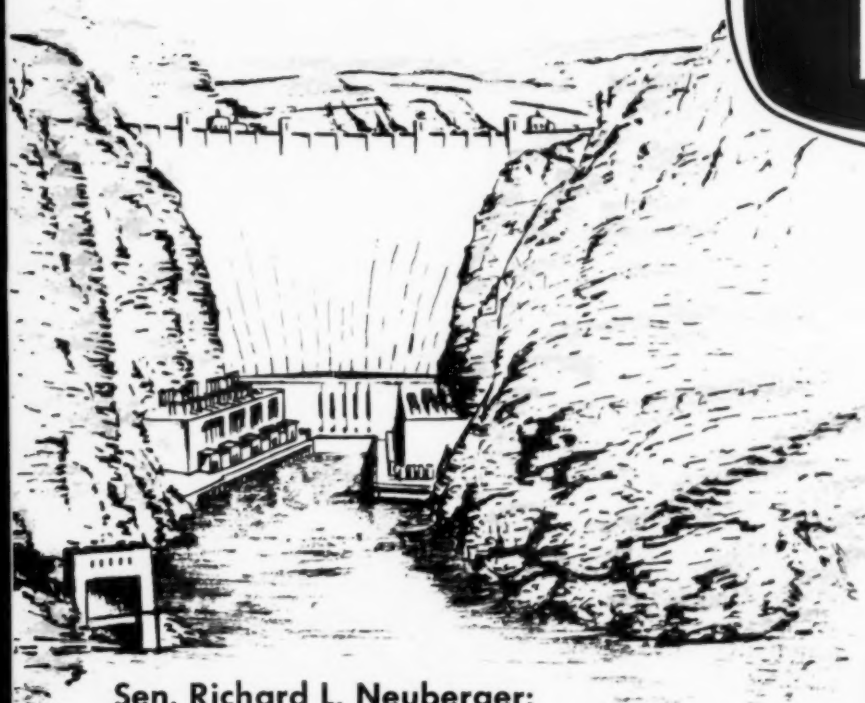
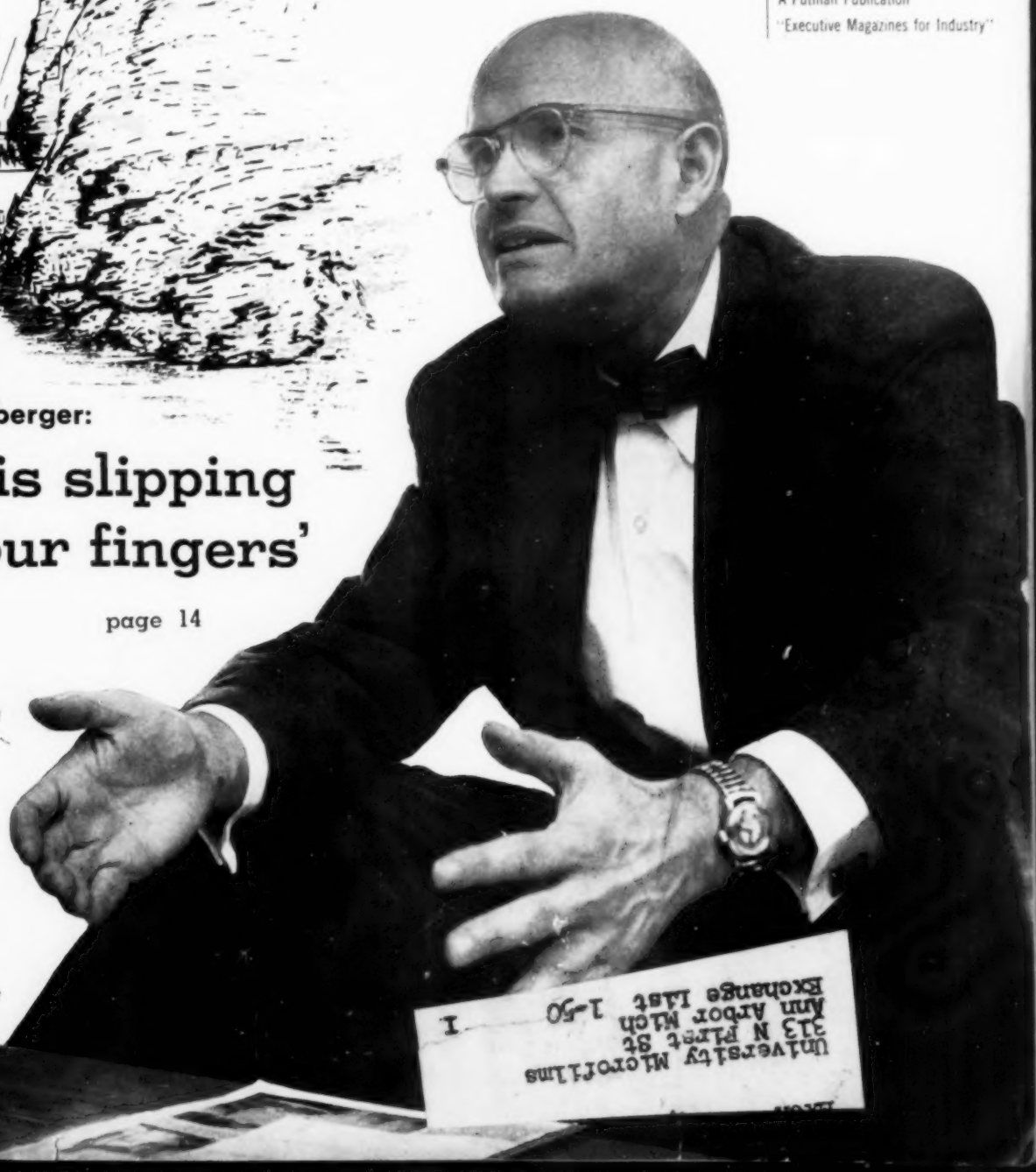


Sen. Richard L. Neuberger:

## 'POWER is slipping through our fingers'

page 14



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Circle 1491 opposite last page

*Feb.* 2-7: AIEE Winter General Meeting; Statler Hotel, New York City.

*Feb.* 3-4: ISA Conference on Chemical and Petroleum Instrumentation; Wilmington, Del.

*Feb.* 3-6: National Industrial Electric Heating Conference; Netherland Hilton Hotel, Cincinnati.

*Feb.* 3-15: College of Business and Public Service Program on Administration for Experienced Executives; Michigan State University, East Lansing.

*Feb.* 16-20: AIME Annual Meeting; Statler and Sheraton-McAlpin Hotels, New York City.

*Feb.* 17-20: Industrial Ventilation Conference; Michigan State University, East Lansing.

*Feb.* 24-28: ASCE Annual Meeting; Hotel Sherman, Chicago.

*Feb.* 24-*March* 8: American Society for Engineering Education College-Industry Conference; University of Michigan, Ann Arbor.

*March* 2-6: ASME Power Division Gas Turbine Conf. and Exhibit; Shoreham Hotel, Washington, D. C.

*March* 10-11: ASME Lubrication Division Symposium; 150 East 42nd St., New York City.

*March* 17-21: Nuclear Congress and Atomfair; International Amphitheatre, Chicago.

*March* 17-21: NACE Annual Convention; Municipal Auditorium, San Francisco.

*March* 19-20: ASME Management Conference; Boston, Mass.

*March* 26-28: American Power Conference; Hotel Sherman, Chicago.

*March* 27-29: Electrical Maintenance Conference; Shrine Exposition Hall, Los Angeles. ◆

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NBP NATIONAL BUSINESS PUBLICATIONS, INC.

FEBRUARY 1958

FEBRUARY 1958
VOL. 74 NO. 2

# POWER INDUSTRY

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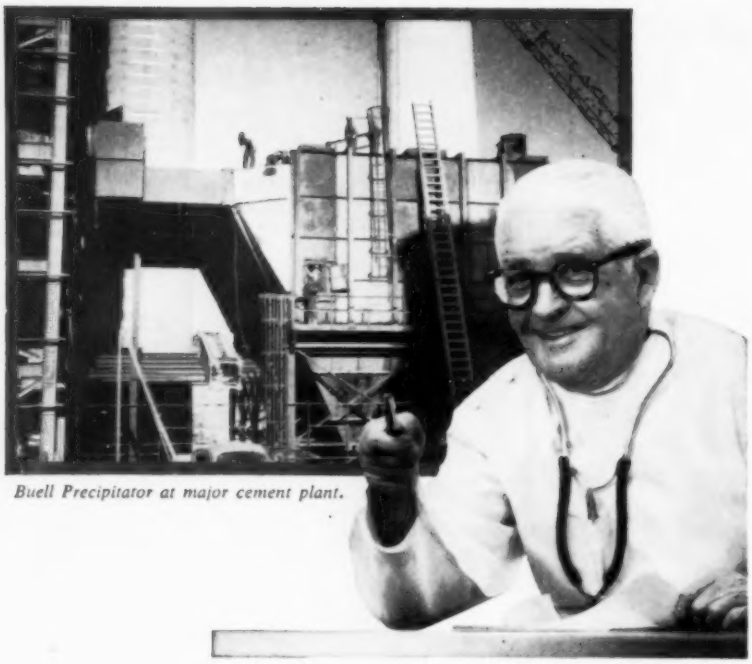

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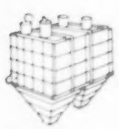

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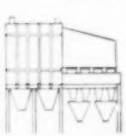

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# REPORTS IN BRIEF

## Scientists, engineers: abandon ivory towers!

Dr. Christopher E. Barthel, Jr., assistant director of Armour Research Foundation, challenges scientists and engineers to get out of their shells and sell themselves to society.

Responsibilities to society include presenting modern technology to the layman in terms he can understand; helping schools and colleges to develop curriculums that will adequately train future engineers and scientists; and assuming industry's administrative burdens to make sure that technological advances are efficiently applied.

### "Non-sparking" tools do spark, Navy says

Non-sparking hand tools and steel tools are both potential source of sparks that can touch off a fire in combustible or explosive atmospheres, according to a U. S. Navy report. Report points out that sparks and possible fires can be caused even by low-sparking materials such as copper.

Contact between a non-sparking and a sparking metal can also create sparks. Non-metallic sparks from low-velocity impact of metal on quartzitic rock is a more dangerous spark source than friction in firedamp or methane-air in mines, according to report.

### Is U.S. builder liable for atom plant abroad?

Harvard University Law School is studying international liability problems that could arise if U.S.-built nuclear power plants should cause serious atomic industrial accidents overseas.

Problem has direct bearing on foreign use of atomic energy for peacetime purposes. Problems of indemnity and mutual liability in an atomic industrial catastrophe are also being studied by Euratom and the Organization for European Economic Cooperation.

(Anderson-Price Act that establishes government indemnity of $500 million over and above private insurance meets this problem within the United States.) Harvard's study will be completed within a year.

### Air-supported structure — to cover satellite dome?

Walter W. Bird, engineer who developed air-supported structures, now used mainly to cover radar installations and swimming pools, predicts such inflated structures could serve as enclosures on satellite observation domes and on permanent space platforms.

These lightweight, space-saving, preassembled units go up fast. Ideal for maintaining even atmospheric pressure around other construction in outer space. Other potential uses: portable hangers, military shelters in temporary bases, gas-tight shelters against bacteriological or radiological warfare.

### 1-year training program for young executives

Sloan Fellowship Program at Massachusetts Institute of Technology strives to train 34 of the nation's most promising young business executives in fundamentals that underlie sound management action.

Made possible by grant from the Alfred P. Sloan Foundation, Inc., the 34 young men

selected will receive support both from the Foundation and from their employers during the year's study at MIT campus.

Candidates must be nominated by their employers. Selection is based on candidate's record of accomplishment, personal qualities appropriate to high-level management, intellectual capacity, and leadership.

### Cast valve meets specs for severe ICBM use

A cast stainless valve has met rigorous Air Force specifications for the Atlas ICBM at a cost 30% under the original weldment design. Original design specified valve of welded wrought stainless steel

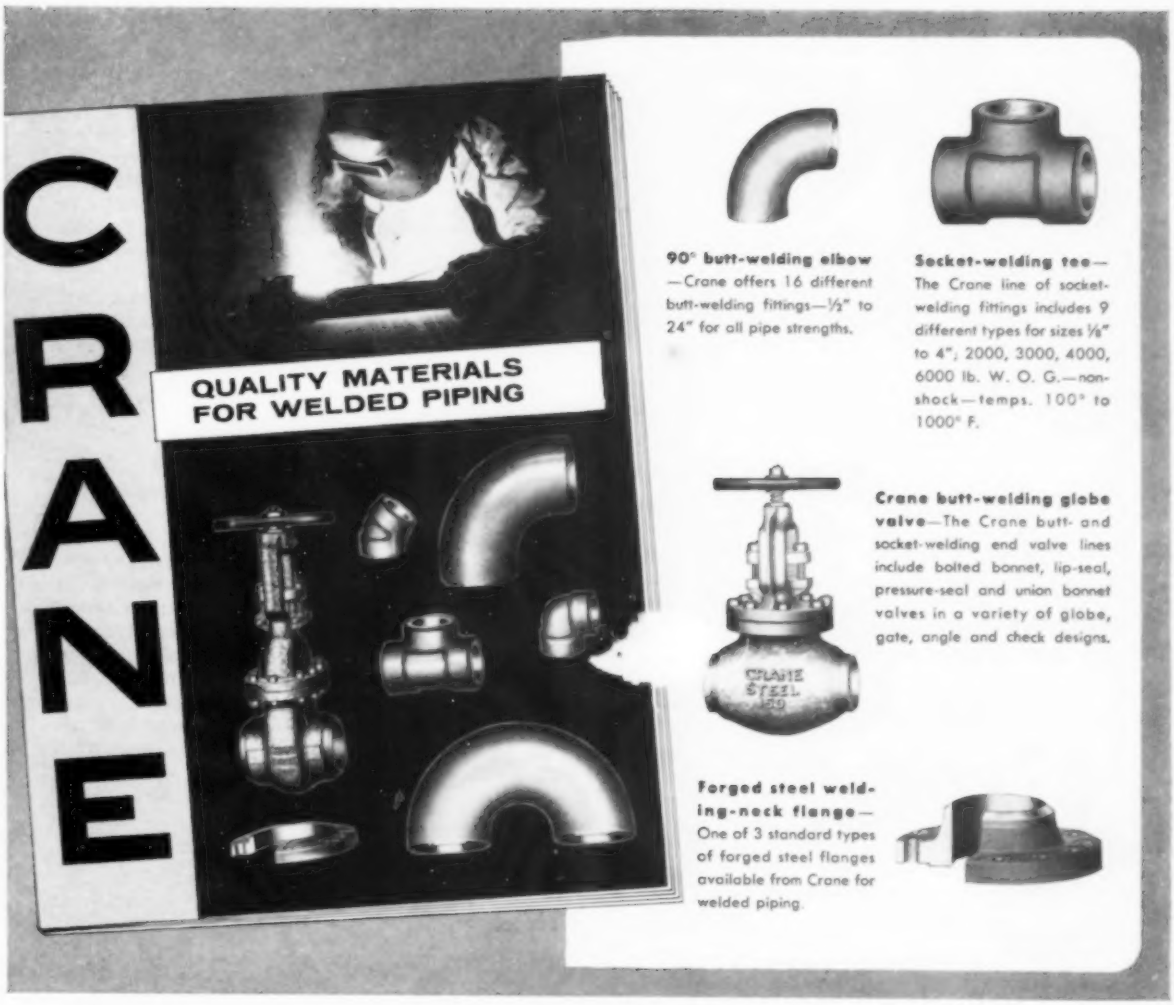
Atlas ICBM is tested for engine performance

flanges and tubes. Design was impractical because of high price, susceptibility of weld zones to intergranular corrosion, and chance of gas leakage at welded seams.

Centrifugally cast one-piece valve body in new design is of Type CF-8 alloy (19% chromium, 9% nickel). Alloy resists corrosion and has excellent shock resistance at subzero temperatures. One-piece design eliminates threat of gas leakage. Convair-Astronautics developed the valve with an assist from the Alloy Casting Institute.

### Argonne will construct 12.5 bev accelerator

Argonne National Laboratory, Lemont, Ill., will house 12.5 billion electron volt accelerator that will produce more accelerated particles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Circle 1495 opposite last page




than any other accelerator in the world—including Soviet Russia's biggest. (Proposed machines at Brookhaven National Laboratory and at European Organization for Nuclear Research's Geneva, Switzerland, laboratories will have higher particle energies.)

Argonne's accelerator will be working in about five years at a cost of about $27 million.

### Nitrate fertilizer is safe, sure explosive

Ordinary ammonium nitrate fertilizer is proving an economical, safe, and efficient explosive in Calaveras Cement Co. quarries at San Andreas, Calif. Calaveras blasts up to 100,000 tons of limestone and shale at a time.

Mixture of ammonium nitrate and diesel fuel is dumped into extra-large diameter holes in rock, then a little dynamite is added to detonate charge. Technique was developed in Maumee Collieries, Terre Haute, Ind.

### Consultant specializes in nuclear field

Dr. Stephen F. Malaker, author and consultant to Oak Ridge National Laboratory, has formed Stephen F. Malaker Associates, a consulting firm offering technical, economic, and legal advise on industrial use of nuclear energy. Firm is located in Newark, N. J.

### Electronic computer helps fight floods

Electronic computers have joined the U. S. Army Corps of Engineers' fight against floods in the Ohio River Valley. Computers convert rainfall over a specific area into flow in stream draining that area. If results show that stream cannot carry off extra rainfall from a storm or series of storms, that information is sent out to flood control cen-


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Circle 1496 opposite last page

ters so that preventive measures can be started.

Computer can even predict advance of a flood wave downstream, taking into consideration peculiarities of channel and tributary inflow.

### B&W to build UP boiler at Huntington Beach

Southern California Edison Co. awards to Babcock & Wilcox Co. contract for Universal Pressure steam generator at new Huntington Beach station. Using same principles as B&W's first commercial UP unit for Ohio Power Co.'s Philo plant, new unit will save money by eliminating many components used in conventional (drum) boilers. UP unit will provide 1,638,000 lb/hr to a 200,000-kw turbine at 2400 psi, 1050 F. Project is to be finished by March 1960.

### Rockefeller funds allow radiation research

The Rockefeller Foundation is granting funds to Harvard University School of Public Health for research and teaching in the health hazards of nuclear radiation. Problems studied will include methods of cleaning air to free it of contamination by radioactive materials and effects on animals of exposure to radioactive materials in air, water, and food.

### Air conditioning biz: good year ahead

D. C. Minard, president of The Trane Co., predicts that air conditioning sales in 1958 will hold to 1957 levels, or perhaps increase slightly. Trend to air-conditioned factories will provide much new business.

Other new business prospects: heating and cooling systems for guided missile and atomic energy programs; air conditioning in city transportation facilities such as buses, local trains, subways. ◆

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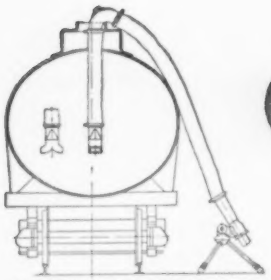

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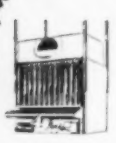

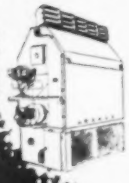

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Circle 1499 opposite last page


# LETTERS

## Of engineers and unity

I have read Mr. Barrett's story with considerable interest and I am in accord with his views. (Jan. POWER INDUSTRY, Unity of the Engineering Profession.)

The Illinois Society has never taken an official stand as a Society; however, our Secretary-Treasurer wrote a very fine article in the October 1957 issue of the **Illinois Engineer** in which he summarized and commented on many points of Dr. Coover's report to AIEE.

The Illinois Society is very "Unity" minded. For example, the Society works with the Illinois Engineering Council on projects common to all engineers, the outstanding one in Illinois being the series of Recognition Dinners honoring newly registered Professional Engineers. They are honored at dinners held at various parts of Illinois.

The Illinois Society and the Illinois Engineering Council work closely on legislative matters and in various other areas.

If the proposals made by AIEE are adopted by NSPE, and other Founder Societies also see fit to go along, "Unity of Engineering" will become more than just a word.

**P. E. Roberts**
**Executive Secretary**
**Illinois Society of Professional Engineers, Inc.**

Mr. Barrett's article is one of the most lucid I have had the pleasure to read on the most important subject of unity in the profession, and should provoke much more serious thought by leaders of the various societies.

**J. Earl Harrington**
**Executive Secretary**
**Western Society of Engineers**

## Oops!

Your article "Economy in a Whisper" (page 22 in the January 1958 issue) was attractively presented. I'm impelled, though, to point out one error you made. While I am a Chief Engineer, I am not, "nor have I ever been" Chief Engineer of Massapequa High School.

**Edgar A. Burt**
**Chief Engineer**
**Orr & Sembower**

▶ *Our apologies to Author Burt. One of the little slips which plague editors moved him 100 miles from Orr & Sembower's Reading, Pa., plant to Massapequa High School on Long Island.* ◆

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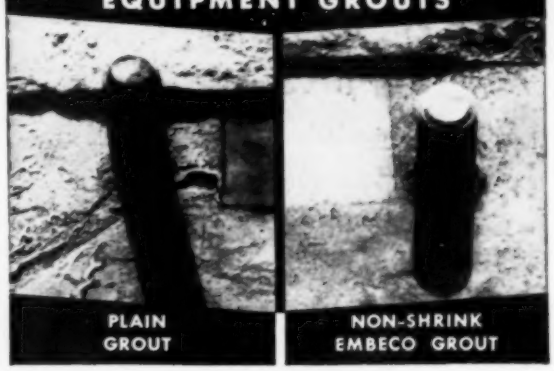


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FEBRUARY 1958
VOL. 74 NO. 2
POWER INDUSTRY

**Are we wasting one of our most vital natural resources — WATER? In July 1957, POWER INDUSTRY brought you an article entitled "Are we running out of water?". Here is another expert's thoughts on this problem. Are we really mis-using our water supplies? Are our experts crying "wolf?" What do you think?**

# Who says we're running out of water?

By A. C. EMBSHOFF
Chemical Engineer, INFILCO Incorporated

**Are we coming to THIS . . . . . OR THIS**

Considerable concern has been expressed from time to time over the adequacy of our water resources. This is of vital interest because of the enormous current water usage and probable rate of increase in the years to come. Before we become too exercised over this prospect, perhaps we should take a closer look at the overall picture. Let's distinguish, if possible, between actual consumption of available supplies and what might be termed "use in transit."

In the consumption category, we should place irrigation water, water evaporated in plant operations, and similar situations where water cannot be recovered, even in part, for other purposes.

A large portion of our water usage may be classified as use in transit. The major portion of it is discharged after use, in a more or less contaminated condition, as waste. This waste, in most instances, is still primarily water. It is, therefore, potentially reusable by others — either as is or with treatment to improve its quality.

Exemplifying use in transit are most of our major rivers and their tributaries. These streams are the source of water for numerous municipalities and industries. Streams are also the receiving reservoirs for wastes from these same municipalities and industries. In other words, wastes of upstream municipalities and industries, diluted by streamflow, become the source of supply for downstream municipalities and industries. Complete treatment of the wastes before discharge, and additional treatment prior to reuse, provides a water of acceptable physical, chemical, and sanitary quality.

The greater portion of water, in industry, is used for cooling purposes. Large volumes are used on a "once-through" basis. In such use, it is subject to temperature rise but little, if any, contamination. Consequently, it is available for further use by others. This situation explains, to a large extent, the average figure of 65,000 gallons of water required to produce one ton of steel.

Actually, one mill in a water-short area does the job with only 1400 gallons of makeup water by intensive conservation and reuse practices. More water is consumed in the latter case than in the former, wherein the water is used in transit and is, therefore, still available for use by others.

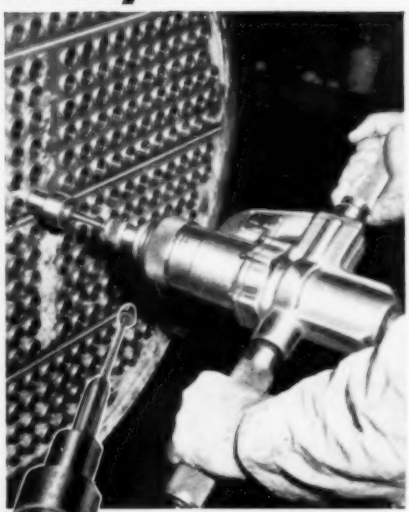
We like to think of water used for domestic purposes as consumed. This requirement, except for water used for watering lawns and gardens, is also in the category of use in transit — the bulk of it is eventually discharged as sewage. This sewage, by suitable treatment, can be made available for reuse for various purposes.

For example, one of the largest steel mills on the eastern seaboard uses 50,000,000 gpd of treated municipal sewage for the major portion of its water needs. Along the

# Roll tubes automatically to uniform accuracy!

AIRETROL is a great new advancement in automatically controlled tube rolling. It combines a powerful pneumatic motor drive and precision control into one compact, lightweight, easy-to-operate tool.

Simple adjustment sets AIRETROL to correct expansion. Torque sensing cam controls expansion automatically to .001 of an inch.



NEW

# AIRETROL
## TUBE EXPANSION CONTROL

EASY TO OPERATE...

QUICKLY ADJUSTED FOR ROLLING TUBES ¼" TO 1½" I. D.

AVAILABLE SPEEDS: 700, 550 AND 400 RPM

AIRETROL eliminates guesswork . . . there's no over or under expansion. Every tube joint can be rolled to maximum tightness and holding strength, assuring longer service.

FASTER ROLLING... LESS OPERATOR FATIGUE

PNEUMATICALLY OPERATED

AIRETROL's cushioned shut-off prevents sudden shock or strain on operator. Entire cycle is smooth, fast, easy. Average operator can roll up to 12 tubes per minute with AIRETROL.

*Send for illustrated and descriptive Bulletin No. 64 on AIRETROL.*

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**CANADIAN PLANT:** Brantford, Ont.

**AIRETOOL**
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

Circle 1502 opposite last page


Pacific Coast, millions of gallons per day of treated sewage are discharged into the ocean. Simultaneously, fresh water is being provided for irrigation and industrial plant usage. Properly treated sewage could be used. When the supply becomes critical, it will be.

Insofar as municipalities and industries are dependent on underground supplies, the shortage of water in a number of areas is indeed critical. Such shortages are the result of withdrawals from the producing aquifers at rates faster than they can be recharged.

**Get by on 5-10%**

Shortages in such situations can often be alleviated or eliminated by adopting mandatory conservation practices such as: return of uncontaminated water to the aquifer for recharge, use of cooling towers in connection with air conditioning and cooling systems. Makeup to such recirculation systems requires only 5 to 10% as much water as once-through operation.

Industrial uses can be minimized by in-plant conservation such as reclaiming and treating process water, normally considered waste, to make it suitable for reuse. And, as previously mentioned, sewage from communities dependent on water wells might be used for other applications where well water has previously been necessary.

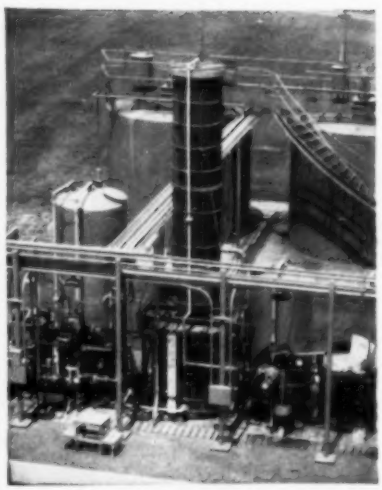
When necessity and economics make such conservation and reuse essential, they will be adopted.

**"Water Everywhere . . ."**

Our water problem in the United States is primarily one of geographic distribution of rainfall rather than an actual water deficiency. According to the U. S. Geological Survey, we have an average rainfall of 4300 billion gpd, of which 1300 billion gpd are available as run-off and for ground water percolation. The remainder returns to the clouds by evaporation.

Thus, about six times our present usage is available to us if provisions are made for its impoundment and distribution to points of use. When economics warrant it, we will find means of utilizing a greater portion of this total available water. ◆


ILLCO-WAY
ionXchange



## "SILICA: 0.003 PPM, OTHER SOLIDS UNMEASURABLE..."

With some doubt as to the outcome, the de-ionization units pictured above were installed outdoors at a Texas power and light company, to replace evaporation equipment as a means of purifying feed water for a high-pressure boiler. After three years, results far exceeded guarantee and expectations. From raw water containing 27 ppm of silica and dissolved solids totaling 365 ppm, the quality of the effluent is reported as: "Silica, zero to 0.005 ppm, average 0.003 ppm. Other solids are unmeasurable."—This is a good example of what modern ILLCO-WAY ionXchange can accomplish.

## BOILER FEED WATER FOR POWER PLANT

The particular plant shown above consists of a cation exchanger, an aerator, and a mixed-bed deionizer. The large tanks in the background hold a supply of regenerants. Operation is manual throughout, a preference of the purchaser. *Results have proved even more economical than expected.*

ionXchange

ILLINOIS WATER TREATMENT CO.

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SPOTLIGHT ON...

## PEOPLE

**Oscar V. Sprague** retires as superintendent of the Utilities Division at **Eastman Kodak Co.'s** Kodak Park Works plant. Joining Kodak in 1908 in the drafting department, Sprague transferred to the power department as power testing and

O. V. Sprague H. A. Decker

technical operations engineer in 1914. In 1931 he became engineer in charge of power operations. **Harold A. Decker**, assistant superintendent since 1956, succeeds Sprague as superintendent. He joined Kodak in 1929 as power development engineer after receiving his ME from University of Rochester.

**Boris M. Wundt** fills new position of turbine structural engineer at **General Electric Co.'s** Large Steam Turbine-Generator Dept. Wundt joined GE as a draftsman calculator in 1924 after immigrating from Poland.

**Allis-Chalmers Manufacturing Co.** promotes **H. A. Bartling** to assistant to the general manager, Nuclear Power Division. Bartling has served A-C as assistant to the director of electrical engineering and as manager of the electronics section.

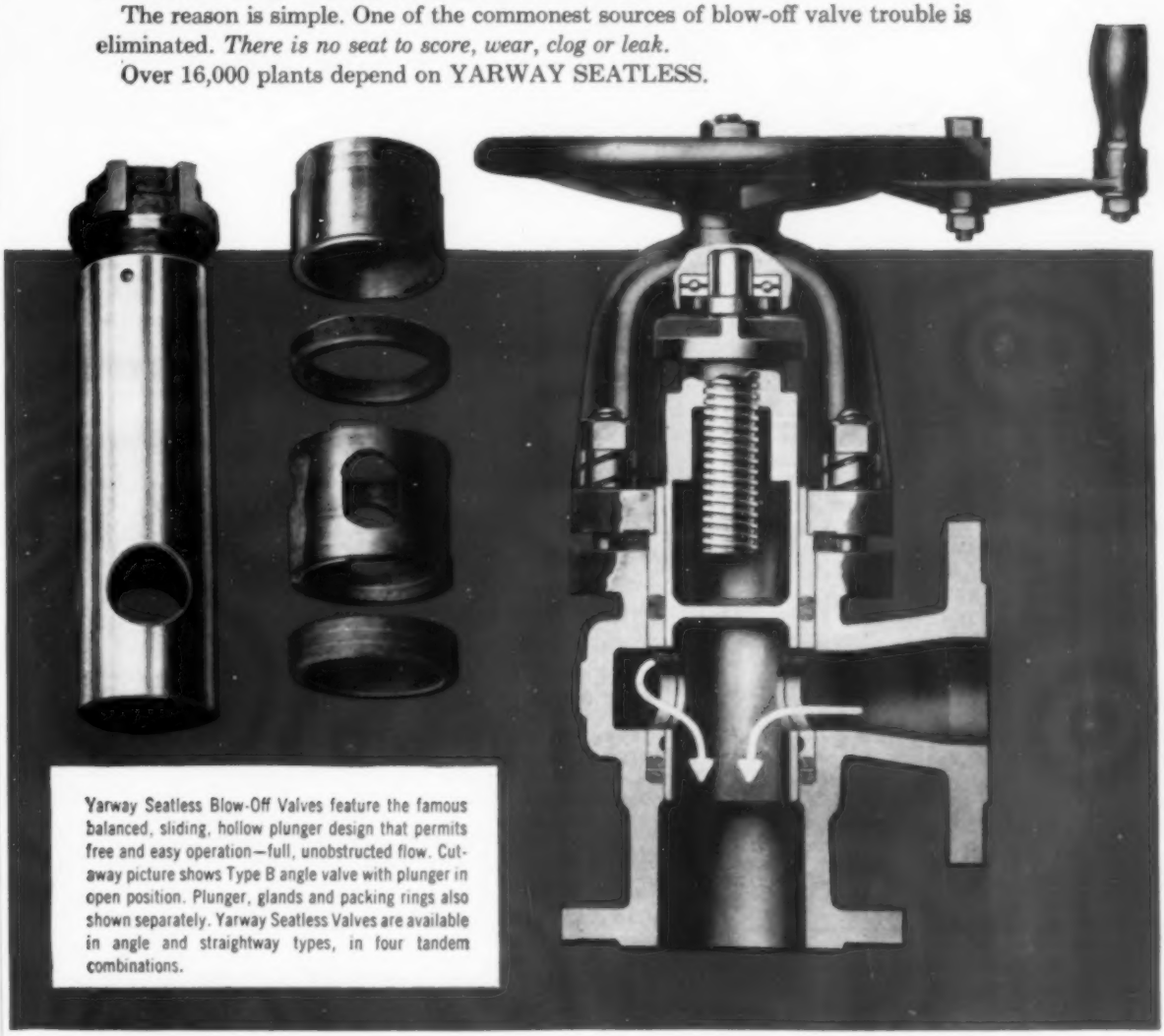
**Stone & Webster Engineering Corp.** president **T. Cortlandt Williams** has been elected to the **National Conference Board.** Williams has served two terms as head of the National Constructors Association. ◆


# seatless means savings

For nearly 50 years boiler plants in low and medium pressure ranges have been saving maintenance time and down-time thanks to dependable, trouble-free blow-down service from Yarway Seatless Blow-Off Valves.

The reason is simple. One of the commonest sources of blow-off valve trouble is eliminated. *There is no seat to score, wear, clog or leak.*

Over 16,000 plants depend on YARWAY SEATLESS.



Yarway Seatless Blow-Off Valves feature the famous balanced, sliding, hollow plunger design that permits free and easy operation—full, unobstructed flow. Cutaway picture shows Type B angle valve with plunger in open position. Plunger, glands and packing rings also shown separately. Yarway Seatless Valves are available in angle and straightway types, in four tandem combinations.

For information on Yarway Seatless Valves, sizes, materials, pressures, etc., write

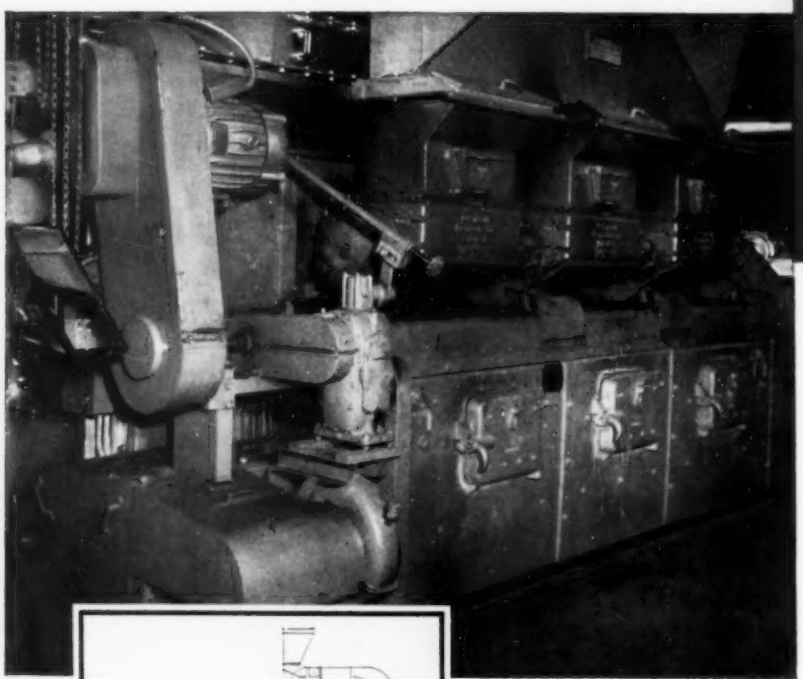
**YARNALL-WARING COMPANY** 100 Mermaid Ave., Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY SEATLESS ...a good way to specify blow-off valves

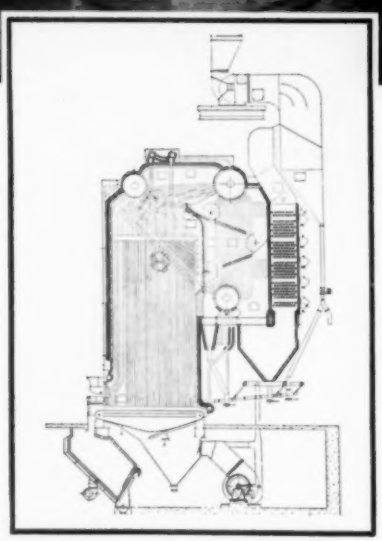
Circle 1504 opposite last page

# Availability?...

**HERE'S A RECORD TO SHOOT AT.. ....Only 5 HOURS OUTAGE in 5 years**



## A Detroit RotoGrate Stoker



**AT OTSEGO**

Detroit RotoGrate Stoker with Wickes Boiler; 650 pounds pressure, 750°F temperature. Cummins & Barnard, Consulting Engineers.

This record of only 5 hours outage in over 5 years is reported by Otsego Falls Paper Mills, Otsego, Michigan, a division of Menasha Wooden Ware Corporation.

Walter Boettcher, Chief Power Engineer says: *"5 hours in 5 years and 4 months is the record of down time due to the RotoGrate Stoker outage"* in this well operated single boiler plant.

*"It operates 24 hours a day—5 to 6 days a week, 60,000 to 90,000 pounds of steam per hour.*

*"Paper mill load fluctuations handled easily without pressure loss."*

This record indicates a fine job of equipment maintenance, but high availability can be taken for granted with the DETROIT ROTOGRATE.

A customer survey taken in all kinds of plants proves it.

## DETROIT ROTOGRATE COSTS LESS

**Cost = initial investment + upkeep + production losses due to outage of equipment. The total is less with RotoGrate.**

DETROIT STOKERS SINCE 1929

**DETROIT STOKER COMPANY**

MAIN OFFICE AND WORKS • MONROE, MICHIGAN

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Circle 1505 opposite last page


SPOTLIGHT ON . . .

## GROWTH

Federal Power Commission has authorized **Transcontinental Gas Pipe Line Corp.**, Houston, Tex., and **Eastern Shore Natural Gas Co.**, Salisbury, Md., to build and operate natural gas facilities. Commission denied permission to Transco to sell natural gas to **Virginia Electric Power Co.'s** Possum Point plant. FPC has approved merger of **Hartford Electric Light Co.** and the **Connecticut Power Co.** All assets and liabilities of Connecticut Power are being assumed by Hartford Electric.

**Boston Edison Co.'s** generating capability is boosted by 140,000 kw with its 1-million-pound Unit No. 4 in operation.

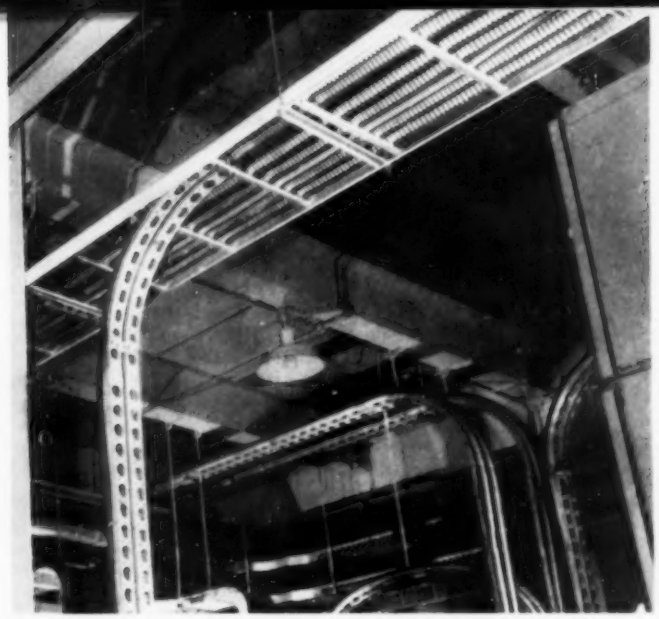
Unit No. 3 (225,000 kw) at **Ohio Power Co.'s** Muskingum River Plant is now in service, boosting **American Gas and Electric Co.** generating capacity to 4,571,000 kw. Another 225,000-kw unit at Muskingum is scheduled to go on the line this year.

**Con Edison Steam Service** will furnish an estimated 175 million pounds of steam annually for heating and air conditioning Chase Manhattan's new home office building in lower Manhattan. Building will be ready for full occupancy in 1962.

**Pyramid Instrument Corp.**, Lynbrook, N. Y., has formed a new division, the **Sargent Electric Corp.**, for manufacture of toggle and trigger switches for small motors, electronic equipment.

**Pickands Mather & Co.**, Cleveland, and **The Enos Coal Mining Co.**, of Cleveland and Indianapolis, have completed an agreement whereby the Enos sales organization is transferred to Pickands Mather.

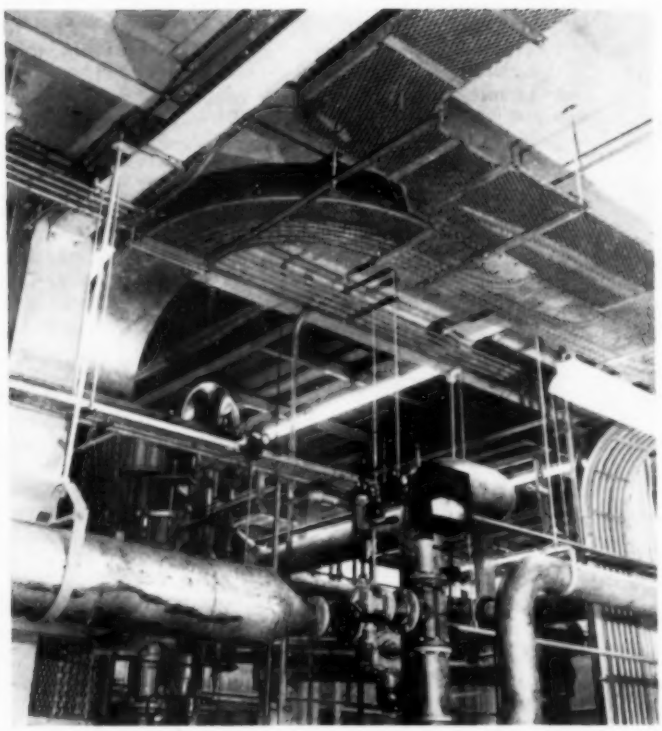
**Stephens-Adamson Mfg. Co.** is occupying new 40,000 sq ft plant at Clarksdale, Miss. New plant is for manufacture of component parts for conveyor systems. ◆



Motor control room where four 2400-volt three-conductor mains come into the plant. Trough and ladder supports permit a neat, flexible installation with complex cable distribution.

*How Glatfelter used cable trough and*

# CUT INSTALLATION COSTS



At top, cable trough supports 12 flexible and five armored cables in 18-inch trough. At right, six armored cables are tied in vertical run of 18-inch ladder. Vertical cable trough carries flexible cable secured by marlin.

By **NEVIN B. ROHRBAUGH**
Chief Engineer
P. H. Glatfelter Paper Co.

When power demands were upped recently because of additional paper processing equipment that almost doubled production, P. H. Glatfelter Paper Co. estimates it saved 25% in time and materials by using cable trough and ladder for electric distribution. A further advantage: with the open support system, additional cables can be laid in the present trough for future needs.

Glatfelter generates most of its own electricity. Four 3-conductor leads of 2400 volts each in armored cable provide the main power supply. From the single distribution center the power is carried to 2400-volt motor controls by armored cable on ladders.

From the same center armored cable on ladders carries the power to four unit substations. Power is then carried from the substations at 440 volts to the drive motors. Multiple conductor cables with two to nine conductors per cable are used.

Motor and motor control circuits are neoprene-jacketed cables up to 500,000 MCM. These cables are supported throughout in Cope cable trough. Ladder is not used for the neoprene-jacketed cables because these cables require continuous support. If ladder had been used instead of cable trough, catenaries might form between the rungs. This would cause cable insulation to creep where cables cross ladder rungs — causing failure.

Cope cable trough is a system of expanded steel mesh with 1¾-inch diamonds. It comes in various widths from 6 inches to 24 inches, and with three sides. A J-type binder strip is welded along the top of the sides and the entire system is galvanized. When supported at 6- to 8-foot intervals, it provides a continuous support and protection for the cables.

Biggest saving with cable trough is in installation time. Cope cable trough is joined with a pin that is driven between barrels welded to the sides of the trough sections.

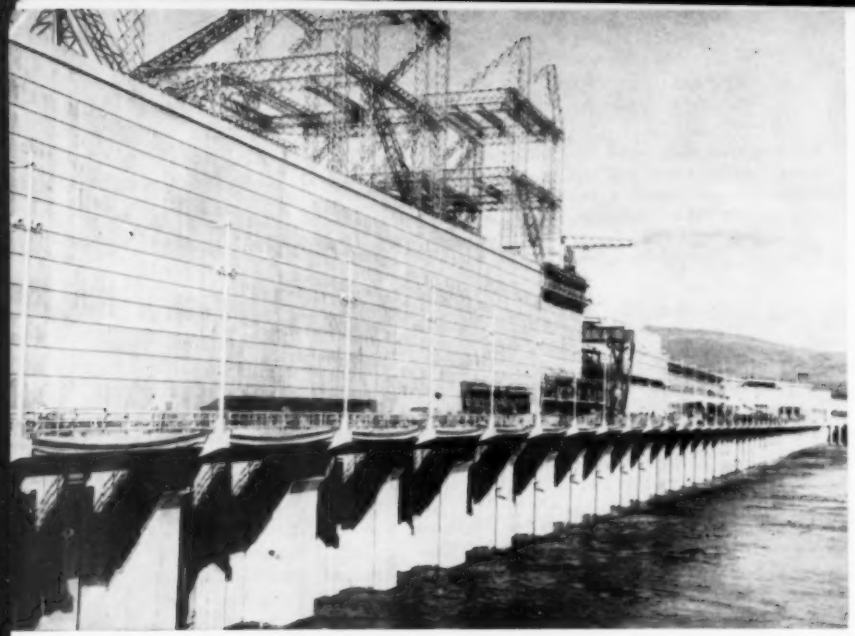
An aluminum plate fits over the bottom of the trough sections as they come together at each connection to protect the cables. Each connection can be made in a few seconds. Standard fittings simplify the problem of getting around obstructions.

Additional cables can readily be laid in the existing trough as power demand increases. Air circulates freely around cables, so that any heat generated by current flow is quickly dissipated.

Glatfelter expects to take advantage of cable trough and ladder design flexibility and installation ease whenever possible in future electric distribution installations.

(Cable troughs and supports are products of T. J. Cope, Inc. Collegeville, Pa.)

Circle 1506 opposite last page.



# POWER
## is slipping through our fingers

**By SEN. RICHARD L. NEUBERGER (D-Oregon)**

On Russia's Volga, Yenesei, and Angara Rivers, steel and concrete rise on three of the world's largest power projects. This is the energy source for vast new industrial complexes planned by the Soviets.

Power development is a major element of Premier Khrushchev's policy to excel the free world on the production line. He has dedicated maximum resources to harnessing the flow of the larger Russian rivers.

This activity is an ominous contrast to a situation that now grips three main prospects for additional hydropower on the North American continent. These are the Columbia, Yukon, and St. John rivers. Together they could produce another 5,653,500 kw — a power supply roughly equivalent to the installed generating capacity of two entire TVA's. Yet, this energy wastes to the sea because of stalemated negotiations at conference tables in Ottawa and Washington.

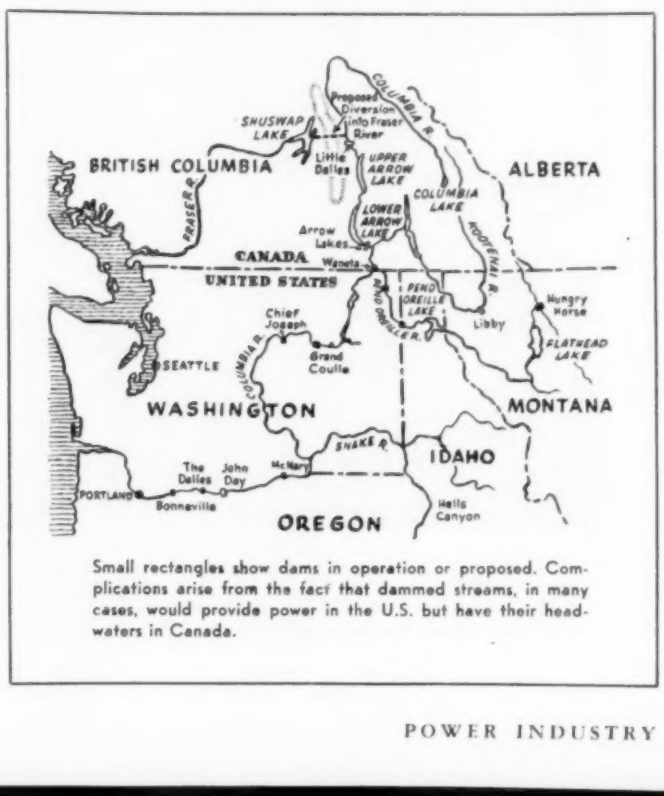
There can be no doubt that power availability will play a big role in the accelerating pace of industrial competition between East and West. We know that some 40 big waterpower plants are under construction in Russia. By 1960, the Soviets plan to produce 320-billion kwh annually, roughly half of our present output. The six major rivers of Siberia, if fully developed, could alone produce 600-billion kwh.

It is especially noteworthy that in the period from 1948 to 1954, Russia's rate of power expansion was 125%, nearly double the U. S. ratio for the same period. And little of this new energy was absorbed by electric blankets, toasters, TV's etc. Almost all the Soviet power was channeled into industrial uses.

In view of Russia's urgent power program, can the United States and Canada afford the luxury of obstinacy or lethargy over development of boundary water-ways?

Hopes for an early settlement, however, are almost as remote today as they were in October 1955. Since then, division of costs and benefits involved in damming the Columbia has been the subject of frequent discussion by the International Joint Commission, the U. S.-Canada agency which has jurisdiction over boundary waters under terms of a 1909 treaty. This year, questions of Columbia development were raised to the level of diplomatic discussion as the result of a conference between President Eisenhower and then-Premier St. Laurent. But the negotiators are still poles apart.

Extraordinary physical characteristics of the Columbia make joint use of the river essential for two nations as determined to get along with each other as Canada and the United States. The Columbia's volume in flood has risen to five-sixths that of the Mississippi. But in winter, it dwindles down to a modest backwoods stream. No other great waterway has such




Small rectangles show dams in operation or proposed. Complications arise from the fact that dammed streams, in many cases, would provide power in the U.S. but have their headwaters in Canada.

wild fluctuations. The average annual maximum flow of the Columbia at the boundary is actually ten times its low-water average! This, of course, adds up to feast or famine for the huge power plants on the American side of the line.

### Dwarf Hells Canyon

But what if the Columbia's crest could be stored to avoid the contrasting droughts and freshets that presently dissipate much of its strength? At Mica Creek, just below the Columbia's horseshoe bend, is a damsite where 10,500,000 acre-feet of water can be retained behind steel and concrete.

The dimensions of such a project may best be appreciated by realizing that the proposed high dam at Hells Canyon would have stored only 3,800,000 acre-feet of water.

Chief of our Corps of Army Engineers, Major General Emerson C. Itschner, has told a Senate subcommittee that the next logical hydroelectric projects are Mica Creek and Arrow Lakes. Enough water could be impounded in Canada to increase by 70% the nameplate rating on generators at such American power plants as Chief Joseph and The Dalles Dams, without pouring any more concrete in the United States.

Comparatively simple equations are involved in sharing a river that forms an international boundary. The benefits are merely divided into two equal parts. But a river that crosses a boundary at right angles presents more difficult problems.

### Divert to Pacific?

Of the Columbia's 1,270-mile length, the first 465 miles flow within Canada. Of the final 180-million acre-feet of water that the Columbia dumps into the Pacific, some 62-million acre-feet come from Canada. So Canada is the source of one-third of the Columbia's flow and practically two-fifths of its length. In addition, many Canadian leaders feel that Canada has complete jurisdiction of the river while it makes its tortured canyon passage inside the borders of Canada.

This attitude supports the proposal of General A. G. L. McNaughton, Chairman of the Canadian section of the International Joint Commission, to divert about one-fourth of the Columbia's flow directly into the Pacific Ocean via an all-Canadian river, the Fraser.

A 1955 engineering study showed that if storage can be obtained at upstream sites like Libby on the U. S. side of the boundary, and at Mica Creek and Arrow Lakes on the Canadian side, the prime power output of Federally-owned dams such as Grand Coulee, Chief Joseph, McNary, The Dalles, and Bonneville might be increased by as much as 1,662,000 kw.

On the other hand, if Canada siphons 15-million acre-feet of water out through the Fraser diversion, Grand Coulee's peak of 1,974,000 kw could be maintained only with the greatest difficulty. Should the United States and Canada agree to mutual storage reservoirs on the upper river, Grand Coulee's production might soar to 2,838,000 kw. The difference more than equals the entire American share of the St. Lawrence Seaway powerplants.

**RICHARD LEWIS NEUBERGER,** Dem. Senator from Oregon, started writing when he was sixteen years old, entered politics when he was twenty-eight. He was in the U. S. Army in World War II, and as a Captain acted as aide-de-camp to Brigadier General J. A. O'Connor, whose specific task was construction of the Alcan Highway. Neuberger is a director of the American Polar Society and his service organizations are the Society of Military Engineers and Veterans of Foreign Wars. He is the first Democrat to be elected to the Senate from Oregon since 1914.

The climate of national policy in both countries is responsible for the present intransigence at the conference tables. A rising tide of nationalism in Canada is one factor. Complaints are frequently aired about American influence over Canada's economy. Export of Canadian water to benefit American powerplants is one aspect of this view.

More alarming, and of greater immediate concern to Americans, is the evident determination of the Eisenhower administration to abandon Corps of Army Engineers plans for comprehensive development of the Columbia River. President Eisenhower himself has epitomized this attitude by his personal insistence upon surrendering the mile-deep Hells Canyon site, to wasteful private underdevelopment.

In view of the President's position, the Canadian storage potential confronts the administration with a dilemma. If an agreement is signed with Canada, the projects downstream in the United States that will benefit are Federal plants, owned and operated by the people of the United States. But adding new generating capacity to these publicly-owned plants does not square with Mr. Eisenhower's program for the Columbia Basin, where he quite frankly favors private utility construction.

### Full Use Threatened

Moreover, prospects for full use of the Columbia's turbulent volume have been threatened since the 1955 Canadian diversion study. A 12- to 15-mile long tunnel would shift nearly 25% of Canada's Columbia water into the Frazer. This would give Canada more than 1,200 extra feet of head—eight times the drop of Niagara Falls— for a volume of water nearly equivalent to the flow of the Colorado River.

From the standpoint of power production alone, this scheme seems to offer Canada the greatest economic benefit. The dams needed to harness the Fraser and the Columbia's diverted flow, however, would likely doom a $32,000,000 Canadian Sockeye salmon fishery industry.

One of the strongest arguments for extracting the last possible kilowatt from the Upper Columbia is that since Grand Coulee Dam was built it is a "fishless river," in the words of Dr. Ira N. Gabrielson, former director of the US Fish and Wildlife Serv-

continued on page 36

**It's income tax time for your company. In this interview, CPA Harold Bland tells POWER INDUSTRY'S Don Hartley . . .**

# how you can help your company SAVE TAX DOLLARS

**By HAROLD BLAND**
Certified Public Accountant

Mr. Bland, many of our readers wish they knew more about corporate income taxes. They don't usually make out company tax returns, but they feel that if they knew more about the taxes they could perhaps make more intelligent decisions about purchase of new equipment and so on. We would like to ask you several questions with this in mind.

**Q** Let's start out with a general question. We know that income tax treatment of expenditures can be classified into two categories — those that result in a deductible expense of the current year, and those that result in the acquisition of an asset.

We also know that cost of factories, equipment, cars and trucks (that is, fixed or long-lived assets) is also deductible from taxable income, but only by deducting the cost in future years.

Now, what determines the difference between expenditures that result in currently deductible expenses and those that result in acquisition of fixed assets?

**A** That's a good start. Look at it this way. Expenditures that benefit only the current year are treated as expenses. Expenditures that benefit future years must be "capitalized."

In other words, the expenditure is treated as increasing the company's assets rather than being deducted as an expense.

To illustrate, let's assume a company with $100,000 in assets and $10,000 in net income contracts to rent a lift truck for one year at a rental of $1000, and contracts to buy another lift truck for $5000. Since the $1000 will benefit only the current year, it should be considered an expense . . . this will reduce the company's profit to $9000.

On the other hand, the company will benefit from the lift truck it purchases, not just this year — but for as long as the truck is expected to be useful. The cost of this truck should be capitalized, making the company's assets $105,000.

Another rule that differentiates the two types of expenditures is that any expenditure whose purpose and result is merely to keep plant and equipment in working order should be treated as an expense.

These, usually referred to as repairs and maintenance, are:

- Repainting the plant or any equipment (even though the repainting is expected to last several years)
- Replacing small parts of large equipment to keep it in operating condition (even though the new parts may last several years)
- Amounts spent on preventive maintenance.

Three types of expenditures that should be capitalized are:

- Cost of additional plant and equipment such as a new wing on the plant, more maintenance or electric equipment
- Money spent in improving or making existing equipment more efficient
- Expenditures that lengthen the estimated useful life of an asset, say overhauling a machine and so increasing its remaining life from two years,

**TABLE 1**

| | 1957 | 1958 | 1959 | 1960 | 1961 | 5-year total |
|---|---|---|---|---|---|---|
| **First Alternative —** | | | | | | |
| Taxable income after deducting the $12,000 as an expense in 1957 | $188,000 | $200,000 | $200,000 | $200,000 | $200,000 | $988,000 |
| Taxes thereon | 92,300 | 98,500 | 98,500 | 98,500 | 98,500 | 486,300 |
| **Second Alternative —** | | | | | | |
| Taxable income after deducting the $12,000 equally over 1958-1961 | 200,000 | 197,000 | 197,000 | 197,000 | 197,000 | 988,000 |
| Taxes thereon | 98,500 | 96,950 | 96,950 | 96,950 | 96,950 | 486,300 |
| **Yearly difference in taxes between the First and Second Alternatives —** | | | | | | |
| Excess of Second Alternative over First Alternative | 6,200 | — | — | — | — | — |
| Excess of First Alternative over Second Alternative | — | 1,550 | 1,550 | 1,550 | 1,550 | — |
| **Cumulative difference in taxes between First and Second Alternatives** | | | | | | |
| Excess of Second over First | 6,200 | 4,650 | 3,100 | 1,550 | 0 | 0 |
| **Cumulative difference in taxes invested at 6%** | 372 | 279 | 186 | 93 | 0 | 930 |

**HAROLD BLAND** is a CPA and an MBA; he is a member of the American Institute of Certified Public Accountants. For several semesters he was a lecturer in accounting and finance at Roosevelt University. Currently, Mr. Bland is a staff accountant with Shepard, Schwartz & Harris, a Chicago firm of certified public accountants.

**TABLE 2**

A machine costing $10,100 has an estimated useful life of 5 years, and an estimated salvage value of $100.

| | Yearly Depreciation Based on 200% | | | Cumulative Depreciation Based On 200% | | |
|---|---|---|---|---|---|---|
| Year | Straight Line Method | Declining Balance Method | Sum-of-Digits Method | Straight Line Method | Declining Balance Method | Sum-of-Digits Method |
| 1 | $2000 | $4040 | $3333 | $ 2000 | $4040 | $ 3333 |
| 2 | 2000 | 2424 | 2667 | 4000 | 6464 | 6000 |
| 3 | 2000 | 1454 | 2000 | 6000 | 7918 | 8000 |
| 4 | 2000 | 873 | 1333 | 8000 | 8791 | 9333 |
| 5 | 2000 | 524 | 667 | 10,000 | 9315 | 10,000 |
| 6 | 0 | 314 | 0 | 10,000 | 9629 | 10,000 |

**Formulas for computing yearly depreciation:**

Symbols used —
YD = yearly depreciation
EUL = number of years of estimated useful life
C = cost

| Method | General Formula | Specific Formula for Third Year |
|---|---|---|
| Straight Line | $\frac{\text{C less salvage value}}{\text{EUL}} = \text{YD}$ | $\frac{\$10{,}100 - \$100}{5} = \$2000$ |
| 200% Declining Balance | $\frac{(\text{C less previous years' depreciation})2}{\text{EUL}} = \text{YD}$ | $\frac{(\$10{,}100-\$6464)2}{5} = \$1454$ |
| Sum-of-Digits | $\frac{\text{Number of remaining years of estimated useful life} \quad (\text{C less salvage value})}{\text{Sum of the numbers representing the years of life of the asset}} = \text{YD}$ | $\frac{3 \times \$10{,}000}{5+4+3+2+1} = \$2000$ |

as originally estimated, to five years.

**Q** Well, since both types of expenditures result in tax deductions, is there any significant difference in how expenditures are classified?

**A** You bet there is. By deducting expenditures from current rather than future earnings, a company defers income taxes. Assuming a company remains in the same income tax bracket over the years involved, deferring income taxes is equivalent to borrowing money interest free.

To illustrate . . . X Corporation's taxable income is $200,000 in 1957, and management estimates it will remain about the same. In 1957, it spent $12,000 on repair work in the factory, and management is not sure whether the $12,000 is an expense or a capital addition. The company's controller recommends treating the $12,000 as a 1957 expense rather than capitalizing it and deducting it from income over the following four years. His recommendation is based on an anticipated saving of $930 (see table 1).

Table I indicates that the total taxes for both alternatives is $486,300. But by deducting the $12,000 in 1957, the corporation will reduce its 1957 tax payment by $6200 ($98,500 — $92,300). As a result, however, its 1958-1961 income taxes will be increased by $1550 ($98,500 — $96,950) per year or a total of $6200.

So you see, total taxes are the same under either alternative. By adopting the first alternative, however, the corporation will have more cash in its treasury from 1957 to 1960. The actual amount of additional cash that would be available to the corporation is shown in Table I as the "Cumulative difference in taxes between first and second alternatives" — $6200 in 1957 $4650 in 1958, etc. (To keep the example from becoming too complex, let's ignore the difference between taxable years and the dates the taxes are paid. The principle and the amounts involved are the same.)

**Depreciation Short Cut**

**Nomograph on next page gives quick estimates of yearly depreciation.**

In effect, the corporation borrows $6200 from the government in 1957, which it will repay in four annual installments of $1550 each, *but with no interest*. Bank interest at 6% on such a four-year loan would cost approximately $930 ($372 in 1957, $279 in 1958, and so on).

But the important assumption in arriving at this $930 savings is that the company will remain in the same income tax bracket.

Smaller corporations, whose taxable income is currently less than $25,000 — taxed at 30% — but who expect to go over that figure in the near future — incomes of more than $25,000 are taxed at 52% — might do better to capitalize questionable expenditures.

The deduction in the later years will reduce taxes at $0.52 for every dollar of expense rather than at the small company's current rate of $0.30 for every dollar of expense.

On the other hand, if a company is in the 52% bracket now, but expects to drop to the 30% bracket, it should probably treat all questionable items as expenses.

So we can say that deferring income taxes is generally advantageous because its effect is equivalent to borrowing money from the government, interest free.

**Q** Mr. Bland, is deciding whether an expenditure is an expense or a capital item an easy task?

**A** Very often, it's not. For example, the cost of concrete lining added to the basement floor and walls is an expense, but the cost of a new concrete floor and new foundation for equipment is a capital expenditure.

Cost of repairing leaks and tuck pointing are also deductible as expenses, but the cost of rearranging lighting and bricking up wall are capital expenditures. **Continued on page 37**

POWER INDUSTRY **nomograph** **No. 4**

# Depreciation in Capital Investment

By POWER INDUSTRY Editorial Staff

DEPRECIATION OF capital investment can be calculated in several ways. One of the simplest methods is "straight line amortization." When such considerations as taxes, insurance, and a fair return (or interest charge) are taken into account, however, calculating equal annual payments becomes involved. The problem, therefore, is to determine if the investment will show an attractive saving after the charges have been assessed to it.

To determine average annual cost by the nomograph, add return on investment (including interest on borrowed funds, it any) to tax and insurance rate on the investment. Then add the depreciation function from table, corresponding to number of years over which investment will be depreciated. Sum of these three is entered on Σ scale and projected through appropriate point on year scale to center reference line. Join this intersection on reference line with total cost on investment scale. Read average annual cost in same units as was used with investment scale.

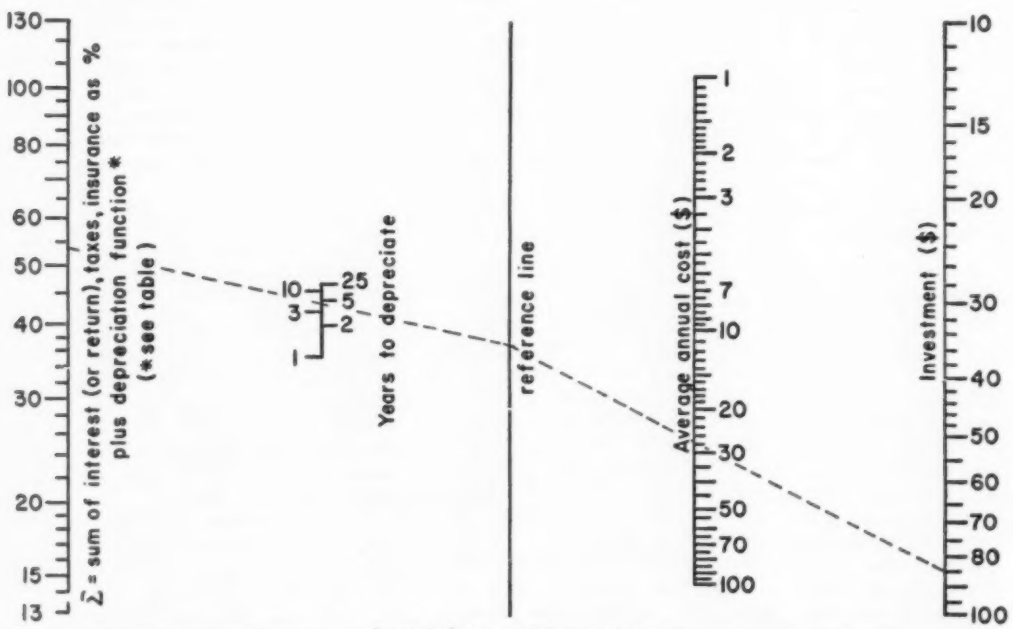
No attempt has been made to estimate "salvage value less removal costs" because this amount varies greatly. This nomograph is valuable for a quick estimate of tangible factors, but don't overlook the intangibles in the final calculations.

EXAMPLE: Purchase of an $85,000 unit is being considered. It is to be depreciated in 4 years, while earning a 10% annual return on net depreciated investment during this period. Taxes and insurance are taken as 3% on this net investment. Adding return on investment, taxes, and insurance to depreciation factor, we get 10 + 3 + 40 = 53. Connect 53 on Σ scale with a straight line to 4 on Years to Depreciate Scale and produce to Reference Line. Connect this intersection to 85 on Investment Scale and read 28 on Average Annual Cost Scale. Average annual cost is therefore $28,000.

Note that this nomograph is only accurate to ± 2%.

**TABLE**
**DEPRECIATION FUNCTION**
(add this function to the percent taxes, insurance, interest)

| Year | Function | Year | Function | Year | Function |
|---|---|---|---|---|---|
| 1 | 100 | 9 | 20 | 17 | 11.1 |
| 2 | 67 | 10 | 18 | 18 | 10.5 |
| 3 | 50 | 11 | 16.7 | 19 | 10.0 |
| 4 | 40 | 12 | 15.4 | 20 | 9.5 |
| 5 | 33 | 13 | 14.3 | 21 | 9.1 |
| 6 | 29 | 14 | 13.3 | 22 | 8.7 |
| 7 | 25 | 15 | 12.5 | 23 | 8.3 |
| 8 | 22 | 16 | 11.8 | 24 | 8.0 |
| | | | | 25 | 7.7 |


Σ = sum of interest (or return), taxes, insurance as % plus depreciation function* (*see table)
Years to depreciate
reference line
Average annual cost ($)
Investment ($)

Power Industry — February 1958


CUT HERE AND FILE

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**POWER BASICS FOR TODAY'S INDUSTRY**

## Fluid mechanics—VII

# SIMILARITY AND MODELING

By **JAMES M. ROBERTSON**
Professor of Theoretical & Applied Mechanics
University of Illinois

**Can you predict behavior of systems employing a variety of flowing fluids? Unusual dimensions? Untested velocities? Yes — through similarity parameters a host of data which are difficult to relate to conditions in other ways can be predicted. This installment of Power Basics shows how and why this can be done.**

Although fluid mechanics is far from being a new subject, it has made tremendous progress in recent years. Many problems of fluid flow are now subject to the analytical approach, and yet we still have many that are too complicated, or that we don't understand well enough to handle theoretically.

Since we still need answers to such problems, we have to approach them experimentally.

This does not mean that fluid mechanics is of no further use to us in solving these problems—on the contrary, fluid mechanics helps to guide our experiments and to universalize the presentation of our results.

Not many years ago, it was claimed that since air and water were obviously such dissimilar fluids, anything learned about the flow of one could not be applied to the flow of the other. Nowadays, anyone familiar with fluid mechanics knows that this is not so. As long as the flow is similar, it doesn't matter what fluid is involved.

To the oldtime practitioner, the manner in which a similarity parameter such as Reynolds number brings order out of apparent chaos would seem like black magic. There is nothing mysterious, however. Similarity works because the various fluid forces act the same in all fluids.

Similarity parameters are used considerably to aid in classifying the phenomena of fluid mechanics. What is learned from one situation may be used in analyzing and understanding other flow situations. Phenomenological and empirical information is universalized with similarity parameters. This conserves the experimental effort needed for our empirical formulations. Formerly, empirical information gleaned in regard to water or oil flow in a smooth pipeline had no applicability to the incompressible flow of air or other gases. Now, with the aid of a Reynolds number presentation in the form of a friction factor, the results from one fluid are directly useable for the other.

The necessary and sufficient conditions that must hold so that we may transfer results found with one fluid and one sized object to another situation are known as similarity conditions. Although two flows may involve different fluids and be at different scales, we can transfer the results from one to the other if the flows are similar and certain dimensionless similarity parameters have the same values.

These parameters not only tell us how to organize and present our empirical information, but also how to plan tests to obtain needed information. In a model test, for instance, consideration of similarity parameters indicates how to use model data in predicting prototype behaviour.

To illustrate the usefulness of similarity considerations, let us take some experimental information on head loss in smooth pipes (fig. 1). Similarity considerations suggest universalizing these results in a friction factor vs. Reynolds number presentation. As fig. 2 shows, this leads to a unique relationship $f = f(R)$

### Similarity Parameters

Fundamental similarity parameters of fluid mechanics are usually called numbers, such as Reynolds number, Mach number, etc. There are only a few of these, each one characterizing (or indicating the possible occurrence of) a particular type of fluid effect.

Another way of stating this is to note that most of these fundamental parameters represent the ratio of inertia forces to another type of force associated with a fluid property. They indicate the existence of a dynamic similarity:

- Reynolds number, which involves the effect of viscous forces in the flow
- Mach number, which involves the effect of compressibility (elastic forces)
- Froude number, which involves interfacial wave phenomena (gravity forces)
- Weber number, which involves capillary phenomena (surface tension forces)
- Cavitation index or number, which involves the occurrence and effects of cavitation.

These five parameters are presented in fig. 3 together with their definitions in terms of fluid properties and basic flow quantities.

As indicated by the fourth column in fig. 3, the first four parameters represent ratios of forces. Three of these can be considered the ratio of velocity to an elementary wave velocity—velocity relative to the fluid or celerity of sound wave, surface (or gravity) wave, or capillary wave. Although this gives a kinematic aspect to our similarity parameters, they are still basically dynamic (i.e. force ratios).

Each basic parameter is associated with a single fluid

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property or the ratio of a single property to the density. In the case of Froude number, this is not apparent until one considers the more generalized form needed when the interface is not between air and water, but rather between two liquids or gases of nearly the same density. Here, the gravitational constant g must be replaced by its effective value $\Delta\gamma/\rho$ involving the difference in the two specific weights.

Mach, Froude, and Weber numbers are sometimes written as the square of the relationships indicated in the third column of fig. 3 (i.e. directly as the force ratios, rather than with the velocity to the first power as indicated). Mach number is then sometimes termed Cauchy number.

Many other dimensionless parameters or coefficients are needed to describe and characterize fluid flow phenomena. These are just as necessary for proper evaluation of flow problems as the fundamental parameters. However, they are not associated with the relative effects or importance of forces associated with fluid properties.

The order of magnitude of one of these secondary parameters gives us no idea of which flow phenomena are likely to be important, as does Reynolds number or Mach number. These secondary parameters are just rational coefficients, but they are most valuable and necessary for presenting and summarizing our empirical information.

A complete list of all secondary similarity parameters would be very long indeed, but some are listed in fig. 4, with their definitions and a brief indication of their application. Of the parameters listed, we have already utilized friction factor f, drag coefficient $C_D$ and pressure coefficient $C_p$.

Some workers in fluid mechanics define a parameter termed the Euler number;

$$E = \frac{v}{\sqrt{2\Delta p/\rho}}$$

This is obviously the square root of the reciprocal of the pressure coefficient $C_p$ and is closely related to the discharge coefficient $C_q$, defined in fig. 4. Since this number can be shown to be the square root of the ratio of two forces (inertia/pressure) it certainly seems to be a fundamental similarity parameter.

The Euler number does not characterize a flow phenomena, however, as do the other parameters listed in fig. 3, and it is not so listed. Similarly, fig. 4 includes the Strouhal number, since this merely describes a fluid flow condition rather than under what flow conditions it might occur.

In the case of oscillatory flow behind bodies, the frequency of which is given by the Strouhal number, it is Reynolds number that defines the flow conditions. Strouhal number is therefore a function of the Reynolds number and not a basic parameter.

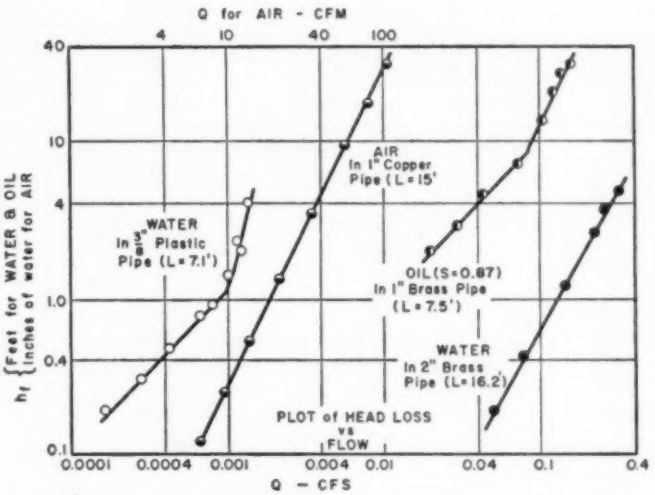
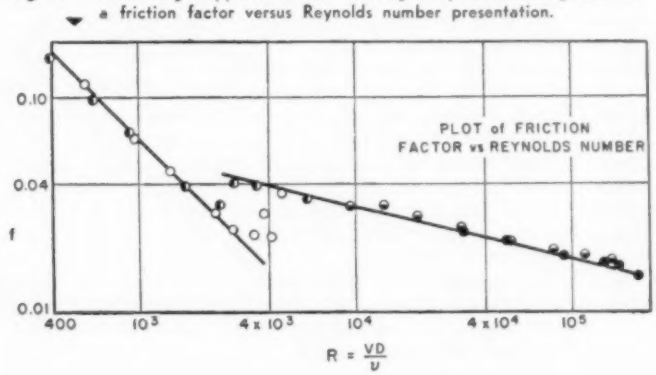



Fig. 1 — Discharge head loss relationships for several fluids in smooth pipes.

Fig. 2 — Black magic applied to data from fig. 1 by universalizing results in a friction factor versus Reynolds number presentation.




### Dimensionless Analysis

Discussion of similarity must include dimensional analysis methods used to obtain the similarity parameters. This approach stems from the basic concept that when an equation characterizing a physical phenomenon is properly expressed, it is dimensionally homogeneous.

The dimensions of the various terms comprising it are the same. You cannot add horses and melons and get any meaningful quantity for an answer. Bernoulli's theorem is an example of a dimensionally homogeneous equation. All three terms

$$\left[\frac{p}{\theta} + z + \frac{v^2}{2g}\right]$$

have the dimension of length.

Similarity parameters are obtained with the aid of dimensional analysis by making a list of all variables involved, i.e. velocity, length, density, viscosity, etc.

Only those variables that are required to define and char-

**Fig. 3 Fundamental Similarity Parameters of Fluid Mechanics**

| "Number" (Parameter) | Symbol | Definition | Physical Concept | Applies to — |
|---|---|---|---|---|
| Reynolds | R | $\frac{VL}{\nu}$ | $\frac{\text{Inertial force}}{\text{Viscous force}}$ | friction: body drag, pipe flow, boundry layer |
| Mach | M | $\frac{V}{\sqrt{K/\rho}}$ or | $\left(\frac{\text{Inertial force}}{\text{Elastic force}}\right)^{\frac{1}{2}}$ or $\frac{\text{Velocity}}{\text{Speed of sound}} = \frac{V}{c}$ | compressibility: transonic, supersonic flow, shock waves, water hammer |
| Froude | F | $\frac{V}{\sqrt{gL}}$ or | $\left(\frac{\text{Inertial force}}{\text{Gravity force}}\right)^{\frac{1}{2}}$ or $\frac{\text{Velocity}}{\text{Speed of surface wave}}$ | gravity waves: ship wave resistance, open channel flow, density currents |
| Weber | W | $\frac{V}{\sqrt{T/\rho L}}$ or | $\left(\frac{\text{Inertial force}}{\text{Surface tension force}}\right)^{\frac{1}{2}}$ or $\frac{\text{Velocity}}{\text{Capillary wave speed}}$ | capillary effects: ripples, spray, drop formation |
| Cavitation index | $\sigma$ | $\frac{p - p_v}{\frac{\rho V^2}{2}}$ | $\frac{\text{Available pressure}}{\text{Dynamic pressure}}$ | cavitation effects: noise, vibration, erosion due to cavitation |

Where: V = flow velocity; L = length (pipe diam, ship length, etc.); $\nu$ = kinematic viscosity; c = acoustic velocity; K = bulk modulus of elasticity (compressibility); $\rho$ = density; T = surface tension; $P_v$ = vapor pressure — **in any consistent units**

**Fig. 4 Secondary Similarity Parameters or Rational Coefficients**

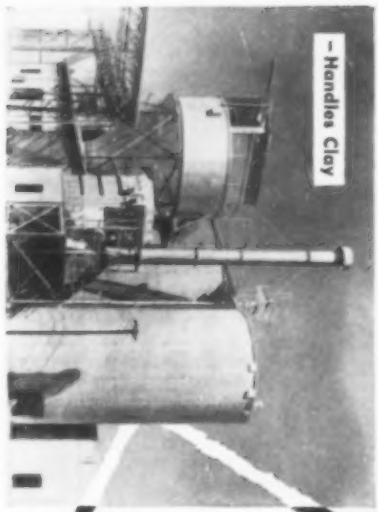
| Symbol | Parameter | Definition | Application |
|---|---|---|---|
| f | Friction Factor | $\frac{2gDh_f}{V^2L}$ | Conduit frictional loss |
| $C_D$ | Drag Coefficient | $\frac{\text{Drag Force}}{A\rho V^2/2}$ | Resistance of bodies (A = pertinent area) (similarly $C_L$ for lift) |
| $C_p$ | Pressure Coefficient | $\frac{p - p_0}{\frac{\rho V^2}{2}}$ | Pressure distribution ($p_0$ = reference pressure) |
| $C_d$ | Discharge Coefficient | $\frac{Q}{A\sqrt{\frac{2\Delta p}{\rho}}}$ | Flow meters, nozzles, weirs (Q = discharge) |
| S | Strouhal Number | $\frac{nL}{V}$ | Flow induced vibrations (n = frequency) |
| $\eta$ | Efficiency | — | — |
| J | Advance Ratio | $\frac{V}{ND}$ | Propellers, fans, pumps and turbines (N = rotational speed) |
| $C_Q$ | Discharge Coefficient | $\frac{Q}{ND^3}$ | Turbomachinery |
| $C_H$ | Head Coefficient | $\frac{Hg}{N^2D^2}$ | Turbomachinery (H = head in feet) |
| $C_P$ | Power Coefficient | $\frac{P}{\rho N^3 D^5}$ | Turbomachinery (P = power) |
| $N_s$ | Specific Speed | $\frac{N\sqrt{Q}}{(gH)^{3/4}}$ for Turbines; $\frac{N\sqrt{P}}{\rho^{1/2}(gH)^{5/4}}$ for Pumps | Turbomachinery |

NOTE: Usually g and $\rho$ are omitted from these relations, Q taken in gpm, N in rpm, and P in horsepower. The values for $N_s$ are thus not dimensionless but nonetheless fundamental.

acterize the problem should be listed. Proper choice requires experience and judgment. Dimensions of the variables are then noted in terms of the fundamental dimensions of force or mass, length, and time. By Buckingham's Pi theorem, if we have n variables and m primary units or dimensions (usually three), then there are n − m possible independent dimensionless parameters that describe our flow problem.

The actual parameters are found algebraically. With any given set of variables, the proper number of parameters will always be obtained. But, depending upon how the algebraic equations are manipulated, different parameters will appear. Any given set is obtainable from any other set, however, through algebraic operations between the parameters in a set. Thus, in a problem involving flow in rough pipe, the parameters f, V $\varepsilon/\nu$, D/$\varepsilon$ might result. The conventional parameters of f, R, $\varepsilon$/D are easily obtained through multiplication of the second parameter by the third, and inversion of the third. ◆

"Nice insulation job, Sid; who'd suspect it was 300°F in this ¼" tubing?"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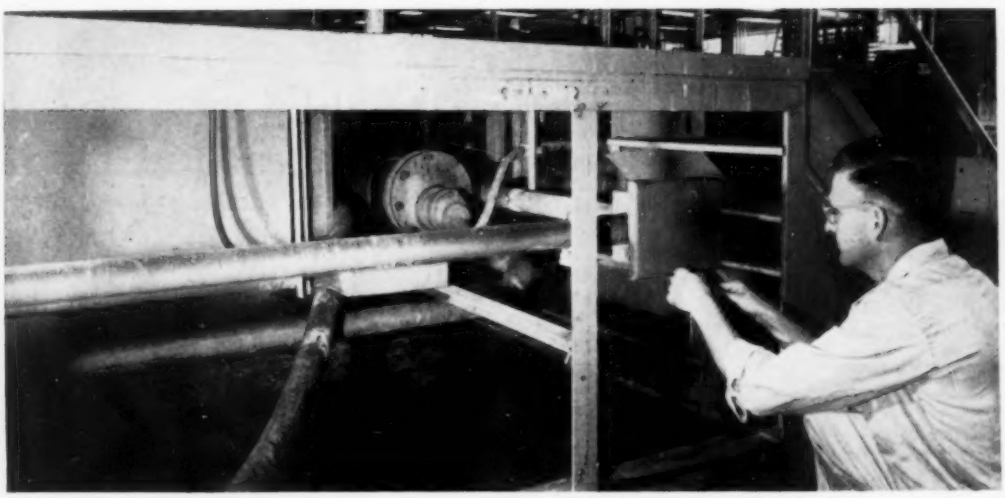
# One plastic solves two problems

## Western Electric finds polyvinyl chloride the answer to problems of . . . .

### . . . corrosion



Previous best life of any material for this fume duct was four months. Hood and duct shown were fabricated of the plastic sheet two years before this picture was taken and were so successful in operation that a complete duct system was installed.

### . . . abrasion

Polyvinyl chloride plastic liner 3/16-inch thick was fitted to hopper and welded in place. It is attached to the hopper by bolts showing around rim. Despite impact and abrasion from coal, it has been in service for more than a year without sign of wear.

Plastic sheet has almost completely replaced sheet metal on some power services equipment at Western Electric Company, Inc., Indianapolis Works. About 3 years ago they experimented with a plastic that has proved so successful that each possible new application is considered first in the light of this plastic.

Engineers have been trying for years to find a material suitable to handle fumes from a particular dip tank. About six months was the best life span they were able to obtain. Then a sample of Boltaron 6200 plastic, a nonplasticized polyvinyl chloride, was tried. It proved so successful that a complete duct installation was made. The hood and duct system has now been in service over two years and there is not a trace of corrosive attack.

Since then, other dip tank hoods and ducts have been fabricated from Boltaron 6200. Even conduit and junction boxes have been made from this plastic for use below the dip tanks. Standard metal distribution equipment had only a very short service life in this location because of splashes and drips from the dip tank.

#### Hoppers Wore Thin

So it was only natural that when hoppers on the coal-fed boilers wore and developed pin holes that eventually grew to large holes due to corrosive action of moisture on the sulfur in the coal, someone should think of using this corrosive resistant plastic.

It was decided that high-impact resistant Boltaron-7200 should be used for the hoppers because of greater abrasion from coal. Boltaron 6200 has higher corrosion resistance but lower impact.

A 3/16-inch thick liner was custom fitted for one hopper and welded in place. It is not bonded to the metal hopper. This liner has been in service for 16 months now, and so far shows no sign of wear. Boiler is one of three Union Iron Works units firing 1½-inch screening bituminous coal through Detroit Rotograte stokers. Eventually all three will be equipped with similar plastic-lined hoppers.

Nonplasticized PVC is not new — it has proved itself in service for some 20 years. It was originally developed in Germany under the trade name Vinidur — not to be confused with the more recently developed modified or high-impact PVC. These have not been in service long enough nor on wide enough applications to guarantee maintenance-free service over a period of years.

Main problem with use of nonplasticized PVC is its fabrication. Western Electric sent a sheet metal fabricator to the manufacturer's plant to learn the technique. Plastic can be machined, formed, and welded.

#### Welding Method

In welding two sheets together, a 30-degree bevel is made on both sides of each edge at the junction of the sheets. At least 1/32-inch of flat surface is left to butt the sheets together. A Boltaron welding rod is used with an electric hot-air gun that provides 450°F air at 8 psi. Air is taken from the mains, passed through an air filter, then through a flexible hose to the Swiss welding gun that has a 110-volt 320-watt heating element built into the handle.

Temperature and air pressure have to be varied somewhat. If the gun is too hot, the sheet will burn a brown discoloration at the edge. If the gun is not hot enough, the

By Donald Hartley
Managing Editor

rod will not stick. Welding really consists of fusing some material from each sheet and from the rod. Rod is held vertically with about four pounds pressure and moved at the rate of about 2 inches per minute. At the same time, hot air from the gun is directed alternately from rod to sheet stock to insure fusing of material from all three elements. This also insures even temperature in rod and sheet, reducing stresses set up as a result of welding. If possible, welding is avoided at the corners of tanks and other places where short radii bends have been made. There is a strong tendency towards high stresses where this is done.

To form sheet stock, it is uniformly heated in an oven to 210 to 230°F and then formed immediately. In making right-angle bends, a Chromalox heater, set up to heat a 4-inch wide strip across the sheet, gives the best results. Uniformity of heating across this area is important to avoid setting up high stresses.

Plastic comes in handy 30 inch by 60 inch sheets and weighs about half as much as aluminum.

Boltaron installations cost about the same as an equivalent stainless steel job, about 15% less than rubber lining, 25% less than brick lining.

Western Electric has found that the plastic is self-supporting, and is using it for fabricating anything to be used in a corrosive environment. Plastic is always tested first in the environment before fabrication is started, and so far, results show that the plastic is far superior to sheet metal in many applications.

(Boltaron plastics are products of H. N. Hartwell & Son, Inc., Park Square Bldg., Boston, Mass.)

Circle 1510 opposite last page.

*Unretouched photo of tube blister... the result of overheating*

...AND THEN THE BLISTER BROKE

This blistered tube was the first sign of trouble in a high-pressure boiler. Accumulation of silica scale deposits on the water side interfered with heat transfer. Overheating caused blistering, subsequent tube failure and inevitable replacement. Proper water treatment can avoid this and other costly conditions such as sludge attachment, return-line corrosion and carry-over.

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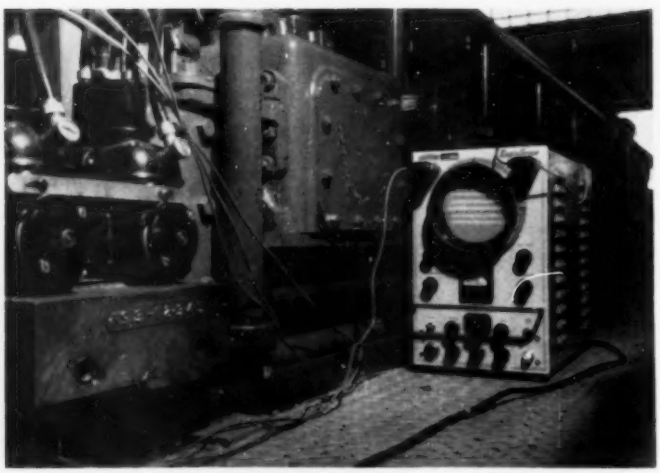
Circle 1511 opposite last page

# NEW DEVELOPMENTS

## New analyzer monitors low-speed engines



Secondary signal information can be viewed with new oscilloscope engine analyzer

Oscilloscope engine analyzer monitors spark-ignited low-speed industrial engines to give a multi-line presentation, cylinder by cylinder. Each cylinder operation, from spark firing to the points open, is shown on picture screen, one line below the other in exact firing order of the engine.

Analyzer can be connected without shutting down engine by using Signal-Clips on a special harness.

System pinpoints such troubles as fouled, misfiring, open, or shorted sparkplugs; defective coils, condensers, wiring, and switches; worn distributor cam and shaft bearings; cylinder-by-cylinder timing; intake and exhaust valves; and burned ignition points.

(Engine Analyzer is a product of Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.)
Circle 1512 opposite last page.

For more information on New Development items circle corresponding numbers on reader service card opposite last page.

### Synthetic belting won't stretch

All-synthetic belting for mechanical power transmission systems, carrier tapes, and conveyor belts won't stretch. Fabric is woven nylon

Synthetic belting is made endless with special lapping press

with extruded nylon core. Flat nylon ribbons in core are processed to lock molecules in position. Belt is almost 100% free of permanent stretch — yet stays elastic.

Belting works well on small pulleys with high belt speeds and high pulley ratios. Elasticity and good grip make it suitable for both short-center and fixed-center drives.

Physical properties and characteristics vary with belt thickness. Thinnest belt consists of a double ply of nylon textile. Number and thickness of plastic ribbon plies sandwiched between the two outer plies determine belt strength. Endless belting may be ordered or belting many be made endless at plant with bevelers and presses.

(Texalon belting is a product of J. E. Rhoads & Sons, 2100 W. Eleventh St., Wilmington 99, Del.)
Circle 1513 opposite last page.

### Makes switching quick — packing or seals

Interchangeable inserts permit fast changeover of general-purpose pump from packing to seals to meet specific pumping needs.

End-suction pump is available in these types: close-coupled horizontal, flange-mounted vertical, base-mounted vertical, and pedestal-mounted horizontal. Sizes are ¼ to 40 hp at 3500 rpm; ¼ to 20 hp at 1750 rpm.

Pump's low impeller velocity gives smooth, quiet operation

Pumps have low NPSH characteristics to meet critical suction conditions. Ideal for circulating, cooling towers, condensate return, booster, hot water, filters, sprinklers. Shaft sleeves are bronze, case wearing rings are nickel-iron. Wide gasket seals prevent leaks between casing and mating parts.

(Type BC End Suction Pumps are available from Aurora Pump Div., The New York Air Brake Co., 42 Loucks St., Aurora, Ill.)
Circle 1514 opposite last page.

### Expand TV chain as needs grow

RCA industrial television camera chain can be used to expand existing closed-circuit TV network or to begin new system. System includes portable vidicon TV camera, self-contained control unit, and viewing monitor.

Design permits operation of two or more camera chains in network with single synchronizing generator. Pulse amplifiers in each control unit distribute and amplify drive pulses.

Portable camera, part of expandable TV chain, weighs only 8 pounds

Synchronization is either 525 lines with 30 frames interlaced two-to-one or 525 lines with 60 fields random interlaced.

Camera operates with 16mm motion picture camera lens, including zoom, telescopic, and wide-angle types. Other features: extra-long deflection yoke to improve picture-corner resolution; fixed aperture correction; and electronically regulated power supply for critical circuits.

(ITV-201 camera chain is available from Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y.)
Circle 1515 opposite last page.

### Gear reducer ends alignment woes

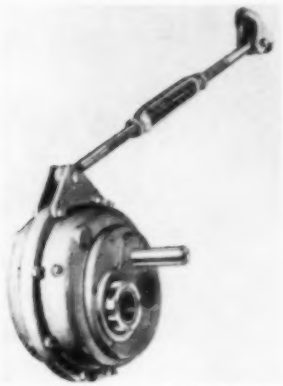
Shaft-mounted gear reducer gives compact, space-saving power transmission while eliminating alignment problems. No motor bases, rails, supporting structures, flexible couplings needed.

Any speed ratio is possible with variable-speed pulleys or by changing sheaves, sprockets or prime mover speed. Easy adjustment of rod and turnbuckle gives proper ten-

sion between drive and driven unit.

Reducer installs direct to driven shaft — mounts vertically or at any angle. Shaft bores are 1 7/16 to 5 15/16 inches, with bushings to accommodate slightly undersize driven shafts. Slightly oversize driven shafts can either be necked down or used with larger reducer.

Roller backstop can be used when protection against reversing of direction is needed,



Gear reducer mounts at any angle

as with inclined conveyors, horizontal mixing drums. Backstop allows only one way movement of driven shaft whether power is on or off.

Single reduction units are 98% efficient and give 4.5:1 speed ratio (nominal). Double reduction units are 96% efficient and give 14.7:1 speed ratio (nominal). Horsepowers are from fractional to 120; output speeds from 8 to 425 rpm.

(Shaft-mounted gear reducer is available from Lovejoy Flexible Coupling Co., 4880 W. Lake St., Chicago 44, Illinois.)

Circle 1516 opposite last page.

### Putty-like tape seals splices, junctions

Electric sealing compound in ribbon form is easy to handle and gives high dielectric strength for sealing and building up cable splices.

Having a putty-like consistency, tape will conform to irregular shapes. Ideal for rounding out sharp corners around terminals, connections,

No sticky fingers with easy-to-use compound

bus bars, and motor lead junctions.

Forms a smooth working surface for overwrapping with electric tape.

Compound has 445 volts per mil thickness average dielectric strength. Won't dry out or become brittle. Is capable of continuous service at 160 F. Resists acids and alkalies, including brine, soaps, detergents.

Tape compound is ½-inch wide, ⅛-inch thick. Each roll holds 5 feet.

(Volseal electrical sealing compound is available from Johns-Manville Dutch Brand Div., 7800 S. Woodlawn Ave., Chicago 19, Ill.)

Circle 1517 opposite last page.

### Package sump pump gives long cycle, high level

Fully-assembled submersible sump pump permits longer cycles and higher water levels than is possible with many similar models. Long-cycling submersible float switch is mounted and adjusted on discharge line. Pump and switch are fully sealed to prevent rust or flooding. Unit

Submersible sump pump handles 200°F water


**NOW···GLOBE OFFERS···**

**two new INTERCHANGEABLE trays for support of cables, wiring and tubing**

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

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*The* **GLOBE** *Company* MANUFACTURERS SINCE 1914

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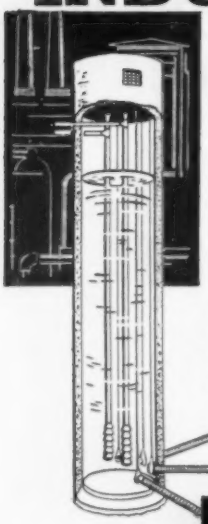
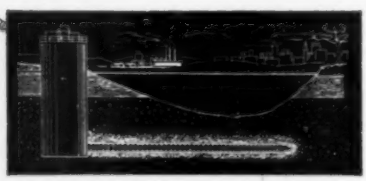
Circle 1518 opposite last page

# INDUSTRIAL water... a job for the RANNEY METHOD



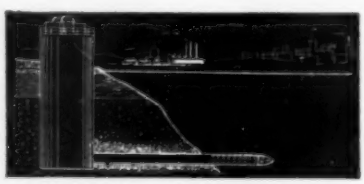
**Conventional Collector.** Proven by industries the world over, the collector that yields more naturally filtered water, with less equipment, less personnel, and fewer pumps than any other conventional collector.



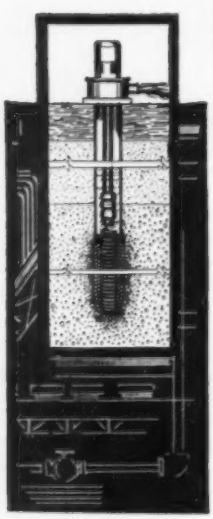
**Infiltration Gallery.** The gallery, engineered by Ranney, provides industry a low cost water supply. The gallery provides large quantities of clear non-turbid water in a revolutionary yet economical way, and it requires no maintenance.

**A Few Industries Now Using the Ranney Method**

Granite City Steel Co.
U. S. Steel Corp.
Wheeling Steel Corp.
Shell Oil Co.
The Texas Co.
American Cyanamid Co.
Eli Lilly and Co.
Allied Chemical & Dye Corp.
Monsanto Chemical Co.
Mead Corp.
MacMillan & Bloedel Ltd.
E.I. DuPont de Nemours & Co.
Olin Mathieson Chemical Corp.
Timken Roller Bearing Co.



**Ranney Intake.** The Ranney Intake, already has proven that plants and factories can obtain surface water both efficiently and economically. The Ranney Intake can usually fit into the design of your engineering department or consultant.



**Ranney Vertube.** Small industry and low volume users can now have a natural gravel vertical water well at low cost. Engineered with the same Ranney precision that has made their method a *must* for industry.

RANNEY METHOD

PI-1

**Ranney Method Water Supplies, Inc.**
841 Alton Ave. Columbus 19, Ohio
*Associated With*
Ranney Method Western Corporation
Ranney Method International, Inc.

Circle 1519 opposite last page




is permanently lubricated. Motor has built-in automatic reset thermal protector. Operates in water to 200°F and will withstand some exposure to steam.

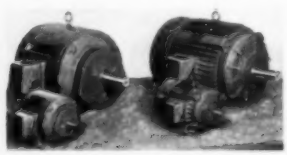
Pumps are available with open impellers for carrying light debris and heavier semi-solids without screening. Enclosed impellers on high-head models require mesh screen.

Pump's high level adjustment can be set for 11½ to 21 inches. Best performance is obtained with full 1¼-inch line and in sumps at least 16 inches dia.

(RSC-MA Enpo pump is a product of Piqua Machine & Manufacturing Co., Piqua, O.)
Circle 1520 opposite last page.

### Large ac motors sized to 445U

Totally protected Series D ac motors now come in large NEMA frame sizes 364U through 445U. Foot-mounted and footless horizontal models are available in protected; totally enclosed, fan-cooled; corrosion-proof; and explosion-proof models. Operate on 208- through 550-volt ac.



Totally protected motors in large frame sizes

Part-winding starting is available. Class A, B, or high-temperature Class H insulation may be specified.

(Large ac motors are available from Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, O.)
Circle 1521 opposite last page.

### Teflon hose fitting won't shake loose

Teflon high-temperature hose fittings lock to hose and lock components to each other —fittings can't vibrate loose. Seals are effected by internal


new TUTHILL SU PUMP UNIT

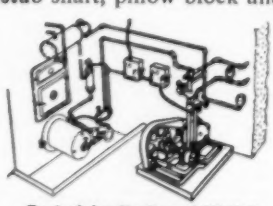
- For Handling Heavy Fuel Oils
- In Packaged Boiler and Commercial Heating Applications

Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅜". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



**Typical Application of SU Unit**

TUTHILL PUMP COMPANY
951 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.
NAME_____ COMPANY_____
TITLE_____
STREET_____
CITY_____ STATE_____

**TUTHILL PUMP COMPANY**
951 East 95th Street, Chicago 19, Ill.
Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada
PUMPS FOR YOUR PURPOSE

Circle 1522 opposite last page

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Present Company .....

Main Product .....

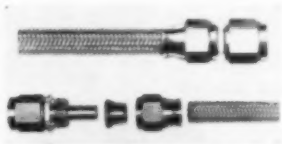
Rating of Company .....

Street Address .....

City ..... Zone No. ..... State .....




pressure to give positive, leak-proof joints. Fittings may be field-assembled without special tools or training. Critical parts are hardened to preserve extra strength—fittings



Fittings lock in place without special tools

can be used again and again.

Design permits inspection of lock before assembly is completed. Fitting blow-offs are eliminated. Straight and elbow couplings are available in -3 to -20 sizes.

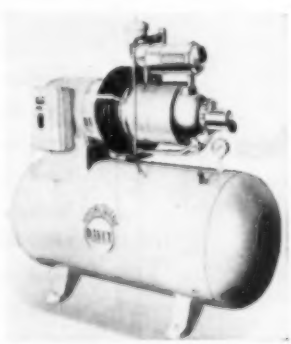
(Seal-Lock Reusable Fittings are a product of Resistoflex Corp., Roseland, N. J.)
Circle 1523 opposite last page.

For more information on items reported in the New Literature section, circle corresponding numbers on reader service card opposite last page.

### Rotary compressors are vibration-free, quiet

Tank-mounted rotary compressors for 100 or 200 psi are quiet and vibration-free. Available in vertical or horizontal tank mountings. Compact design saves up to 60% of installation space needed by conventional compressors of same output rating. Modulation, start-stop, or combination modulation and start-stop unloading mechanisms available. Compressors are available in 2, 3, and 5 hp models.

(Davey Hydrovane Rotary compressors are available from Davey Compressor Co., Industrial Div., Kent, O.)
Circle 1524 opposite last page.



Rotary compressor needs no special foundation

### Weld stainless pipe the easy way

Aligning stainless steel pipe for welding is simplified with connector that fits over ends. Permits in-place preassembly of pipe and fittings, eliminates icicles inside connections. Aligning connectors may be used with lightwall stainless steel pipe (Schedules 5 and 10 and Speedline fittings) and conventional Schedule 40 systems.

Connector holds sections to be joined

(Aligning connector is a product of Speedline Stainless Steel Fittings, Div., Horace T. Potts Co., 504 Erie Ave., Philadelphia 34, Pa.)
Circle 1525 opposite last page.

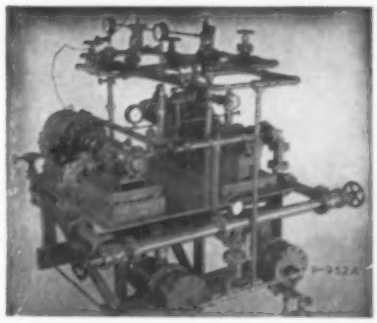
### Silicon rectifiers give 250-volt dc power

Silicon power rectifier is designed for use where 250-volt dc power is needed for operating cranes, machine tools, lighting, magnetic chucks. Circuit breaker protects against dc overloads and short circuits. Dynamic braking protective panel available when regenerative dc power is used.

Ac input ratings are under 600 volts, three phase, 60 cycle. Dc outputs for two-wire 250-volt systems are 75 through


COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

***MORE COMPACT THAN EVER . .***



P-952-A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

**NATIONAL AIROIL**

## FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return, and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40 — very interesting and informative.

OIL BURNERS and GAS BURNERS for Industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
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DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
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SPECIAL REFACTORY SHAPES

**NATIONAL AIROIL BURNER CO., INC.**

**1350 E. Sedgley Avenue, Philadelphia 34, Pa.**
**Southwestern Division:**
**2512 South Boulevard, Houston 6, Texas**

Circle 1526 opposite last page

## Solve these 6 problems with INDUCED DRAFT BIFURCATORS®

- Eliminates puff-backs when starting with cold stack.
- Permits operation with no stack at restricted locations. Saves cost of erecting tall stacks.
- Corrects down-draft condition that develops near mountains.
- Corrects down-draft effect from adjacent tall buildings.
- Compensates for insufficient size and height of stack.
- Permits additional boilers without changing existing stacks.

Regardless of the problems posed by weather or surrounding conditions, the Induced Draft Bifurcator provides *instant* draft . . . and maintains *constant* draft at the required rate of flow of flue gas through your boiler system.

*For complete details, see our section in Sweet's Engineering or Industrial Construction Catalog*

FOR FURTHER INFORMATION SEE OUR CATALOG IN SWEET'S OR WRITE FOR COPY

**De Bothezat FANS**

A DIVISION OF

**American Machine and Metals, Inc.**

DEPT. PI-258, EAST MOLINE, ILLINOIS

Circle 1527 opposite last page



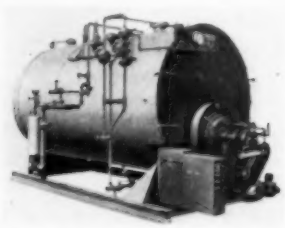

600 kw. Three-wire 125/250-volt system units are 75 through 150 kw.

Rectifiers operate continuously at 100% load, at 125% load for 2 hours, and at 200% load for one minute. Conversion efficiency at full load is about 94%.

(Silicon power rectifier is available at General Electric Co., Schenectady, N. Y.)
Circle 1528 opposite last page.

### Fiberglass sheath insulates boiler

Package boilers are completely factory assembled, wired, and tested — 80%-plus efficiency guaranteed. Boiler comes in metal jacketed heat-resistant fiberglass to eliminate insulation work at job site.



Boiler trim is fitted at factory

Forced- and induced-draft models come in 25- to 600-hp ratings; pressure forced-draft models in 10 to 100 hp. Units fire all grades of fuel oil, gas, or both.

(Webco package boilers are a product of Western Boiler Co., 1600 North Indiana St., Los Angeles 63, Calif.)
Circle 1529 opposite last page.

### Alarm system has no moving parts

Audible and visual alarm system has static switching circuit with no moving parts (such as relays or solenoids) — so breakdowns from mechanical or electrical failures can't happen. Design also eliminates need for hermetic sealing to keep out dust or corrosive atmospheres. Unit's compactness permits more alarm stations in less space

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Equipment ratings:
Boilers: Num .... Total Capacity: ..... lb/hr
Total connected electric load .....kva
Total transformer capacity .....kva
Total number electric motors .... Total hp ....
Total number pumps ..... Total hp .....
Total number compressors ..... Total hp ....
Products manufactured .....
Signed .....
Date .....

than conventional systems use.

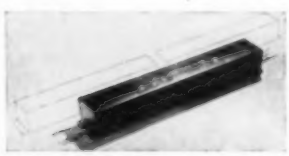
Alarm system can be used on all processes or systems that require annunciators. Operates from standard ac or dc power source.

Static switching circuit features no moving parts design

(Scammit is a product of The Scam Instrument Corp., 1811 W. Irving Park Rd., Chicago 13, Ill.)
Circle 1530 opposite last page.

### Single-can ballasts — smaller, weigh less

New one-can fluorescent ballasts replace two-can ballasts for 4-, 6-, and 8-foot power groove and VHO lamps for cold weather operation. New ballast design saves up to 8 pounds and 12 11/16 inches per unit over comparable two-can ballasts. Smaller size permits more streamlined fixtures with easier assembly.



One-can ballasts are smaller in size, weigh less

(One-can ballasts are available from Jefferson Electric Co., Bellwood, Ill.)
Circle 1531 opposite last page.

### Regulates pressure for spray gun

Low-pressure (0 to 50 psi) regulator maintains precise control of paint pressures between pump outlet and spray gun. Regulator is unaffected by solvent action and abrasion. Handles any material with near neutral pH.

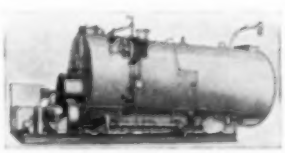
Removable wrench adjusting key allows permanent pressure setting. In-line regulator has 60-pound gage to keep outlet pressure at 50 psi maximum. Regulator design eliminates restricting passages that could clog. Cleans easily by back flushing.

Regulator keeps even pressure

(Regulators are available from Alemite Div., Stewart-Warner Corp., 1826 Diversey Pkwy., Chicago 14, Ill.)
Circle 1532 opposite last page.

### Factory-assembled boiler controls

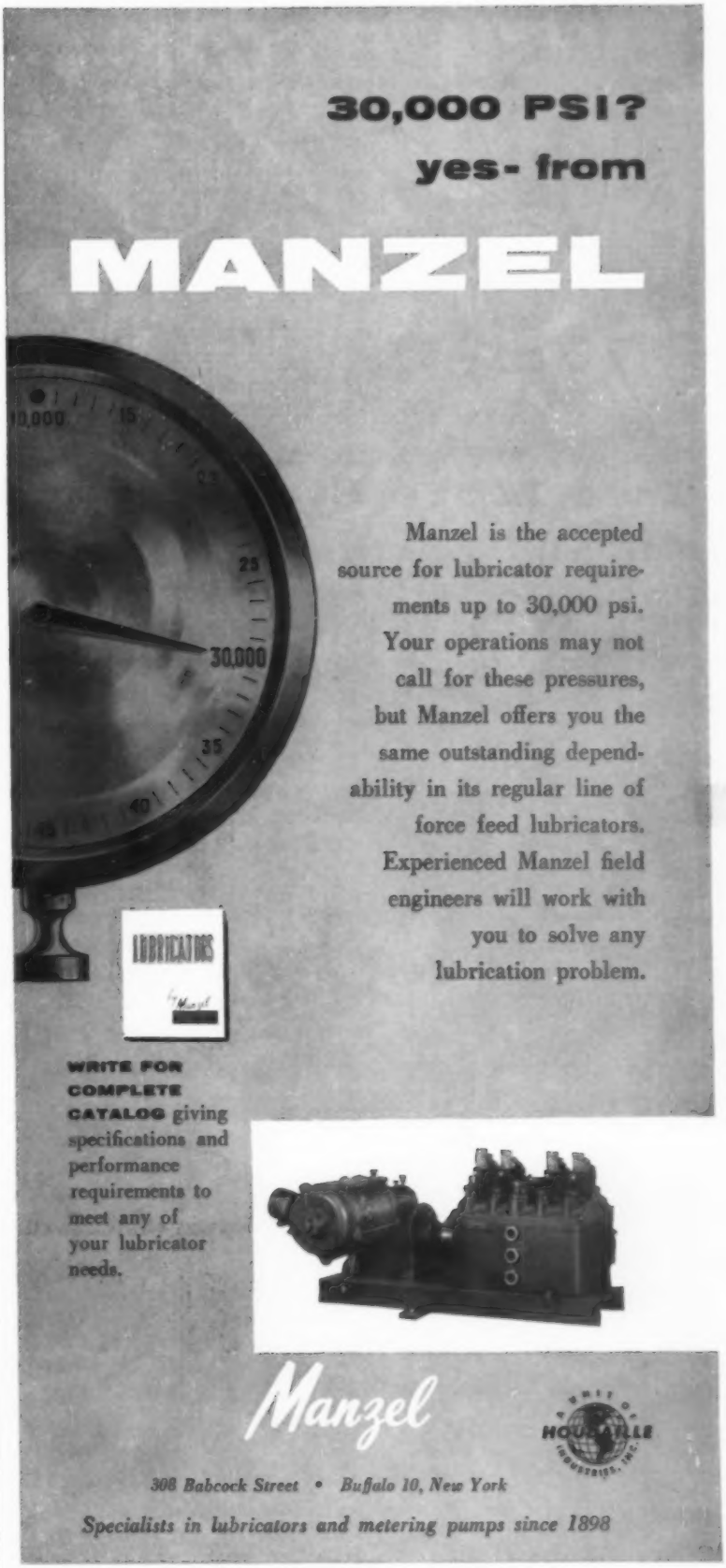
Fire-tube package boiler features three-pass design with gas vent in rear. All safety controls and instruments are piped, wired, and factory-assembled. Units are factory fire-tested with burner and fuel specified.



Boiler is ready for work when delivered

Boiler has 5 sq ft of heating surface per developed horsepower. Forced draft provides precise control of excess air and $CO_2$.

(FT package boiler is a product of Erie City Iron Works, Erie, Pa.)
Circle 1533. ◆



30,000 PSI?
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Manzel is the accepted source for lubricator requirements up to 30,000 psi. Your operations may not call for these pressures, but Manzel offers you the same outstanding dependability in its regular line of force feed lubricators. Experienced Manzel field engineers will work with you to solve any lubrication problem.
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WRITE FOR COMPLETE CATALOG giving specifications and performance requirements to meet any of your lubricator needs.
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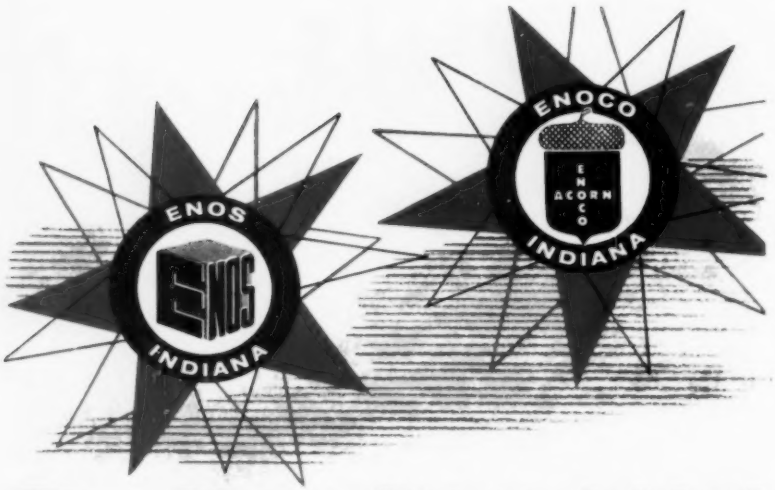
Circle 1534 opposite last page




# Two More Stars Added

The Enos mine, located at Enosville, is Indiana's largest strip mine with 70,000,000 tons in reserve.

The Enoco mine, at Bicknell, is one of Indiana's largest underground mines with 40,000,000 tons in reserve.

Both mines produce high quality 5th seam Indiana coal for utilities and other industrial purposes. Shipments for 1957 ran over two million tons.

May we serve you?

Modern tipple at Enoco mine.

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Circle 1535 opposite last page


# NEW LITERATURE

Reviews of books and industrial bulletins describing equipment, supplies, services

### Graphs, charts give handy air flow data

Performance graphs and charts in 26-page bulletin give useful data on steam capacities, air flow resistance, and other air flow data. Other timely topics include steam coil selection and use; hot water coils; definitions and formulas for computing heater capacities.

Bulletin also gives specific data on industrial heating and ventilating units for makeup air or plant heat load. Covers horizontal, vertical upright, vertical inverted, and L-shaped heater arrangements. Fan, coil, filter, and damper sections are described. Available for the first time is automatic disposal air filter.

(Bulletin 750A is available from American Air Filter Co., Inc., Louisville 8, Ky.)
Circle 1536 opposite last page.

### Semi-float couplings need no maintenance

Bulletin describes semi-floating shaft couplings designed for engine-driven generators, etc., where units are spaced apart and only one bearing is provided for each unit. Couplings need no maintenance or lubrication—when properly installed they should last indefinitely.

(Form 99 is available from Thomas Flexible Coupling Co., Warren, Pa.)
Circle 1537 opposite last page.

### System smashes air film to produce more heat

Master steam control system for boiler circuit destroys by pulsation heat-resisting condensate and air films that slow down steam production.

System also supplies de-aerated make-up water at proper temperature, automatically keeps condensate return balanced against steam supply to prevent waterlogging. Opens system for fast start after shutdown, and monitors entire system. It can be installed in conventional steam system with only minor piping changes.

Twenty-page bulletin reviews theory of master steam control system, describes system components, and tells how to install system in existing steam generating equipment.

(Bulletin on Velocity Steam Master Control Unit is available from Velocity Steam Production Engineering, Inc., 1340 First National Bank Bldg., Chicago 3, Ill.)
Circle 1538 opposite last page.

### Manual reviews pH control systems

"The Industrial pH Handbook" reviews industrial pH control systems, their operating principles, application details, and components. Provides a convenient reference for anyone involved in designing, engineering, purchasing, or operating a pH system.

It includes bibliography to literature on pH measurement.

(To obtain this 80-page handbook remit $2.00 direct to Process Instruments Div., Beckman Instruments, Inc., 2500 Fullerton Road, Fullerton, Calif.)

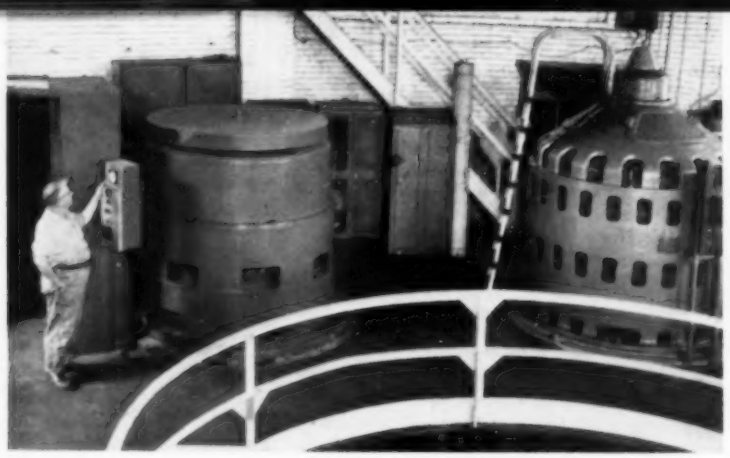
### Design data on new switchgear line

Low-voltage power switchgear is described in 20-page bulletin. Redesigned power circuit breakers and switchgear carry unit ratings from 225 to 4000 amps.

Circuit breaker innovations include quick-make manual closure, pull-down handle, simpler trip unit, continuous-

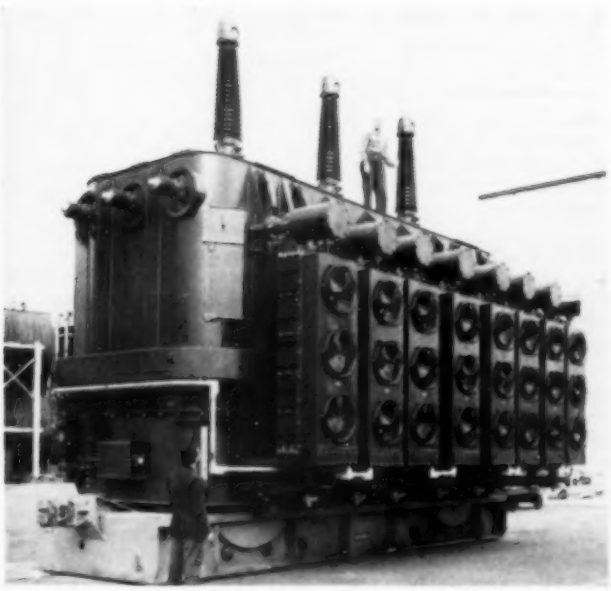
continued on page 32

# PHOTO NEWS



Pump at left is one of two installed by Dravo Corp. in Jones & Laughlin Steel Corp's. Aliquippa Works pump house. Operating on 60-cps purchased power, 40-mgd pumps will supplement five 25-cps pumps to supply new strip mill, oxygen furnace, and oxygen plant.

Robert W. Gillette (right), chairman of the New York Section, AIEE, presents check for $15,000 to Walter J. Barrett, president of United Engineering Trustees Inc., and AIEE. Contribution is to fund for new Engineering Center to be erected on United Nations Plaza, New York.



Last of three 315,000-kva power transformers was recently shipped to Memphis, Tenn. Made by General Electric in Pittsfield, Mass., transformers are largest in their voltage class ever built. Units are about same width and height and only three feet longer than a 1947 transformer with only 145,000-kva capacity.

Shippingport, Duquesne Light Co's. atomic power plant, went on the line December 18th. Construction entailed moving 400,000 cu yd of earth, placing 56,000 cu yd of concrete, and nearly 6000 tons of reinforcing steel.

Looking like belated Christmas presents, Federal Pacific Electric Co. now ships DMB air circuit breakers in polyethylene bags containing silica gel. Sealed breakers are placed in tough cartons attached to disposable wooden pallets to ensure dust-free delivery and storage without damage from humidity.

current ratings. Application tables give complete breaker ratings, control-power needs, and ranges of overcurrent trip devices.

Bulletin includes dimensions, sample specification form, and layout drawing of typical switchgear assembly.

(Bulletin 6004-C is available from I-T-E Circuit Breaker Co., Switchgear Div., 19th & Hamilton Sts., Philadelphia 30, Pa.)
Circle 1539 opposite last page.

### Metal gaskets for steam, oils, gases

Spiral wound metal gaskets are recommended for use against steam, oils, gases and liquids, including most chemicals in high-pressure, high-temperature applications.

Gaskets consist of spiral wound strips of V-shaped preformed stainless or cold rolled steel alternated with layers of asbestos or Teflon.

(Bulletin AD-104 gives complete engineering data, 12 pages, and is issued by The Garlock Packing Co., Maple Ave., Palmyra, N. Y.)
Circle 1540 opposite last page.

### Data sheet shows magnetic gages

Data sheet describes magnetic liquid level gage for safe, accurate gaging of explosive or inflammable liquids. Gage handles pressures to 2500 psi at 600 F.

(Data Sheet 306 is available from Jerguson Gage & Valve Co., 80 Adams St., Burlington, Mass.)
Circle 1541 opposite last page.

### Gives maintenance tips on commutators, rings

Proposed six-article series on commutator and slip ring maintenance is designed as both trouble-shooting guide for veteran maintenance man and handy introduction for anyone "breaking in."

Each article probes some aspect of the problem of keeping commutators and slip rings at peak performance. Written in familiar "shop-talk" language, series tells what to do to solve common maintenance problems.

No. 1 in series is available now. Others in series will be sent at regular intervals as they become available to all who receive first article. Folder designed to hold entire series is also supplied.

("Commutator and Slip Ring Maintenance" series is available from Ideal Industries, 1023-A Park Ave., Sycamore, Ill.)
Circle 1542 opposite last page.

### Polyvinyl chloride tape for pipeline protection

Data file gives technical data on polyvinyl chloride tapes that protect both underground and aboveground piping systems from corrosion.

Features include high shock-impact and soil-stress resistance, self-healing ability, no moisture migration, built-in, color coding, and low cost.

Data File PF-7 includes color swatches, data on tape wrapping machines, tables of pipe coverage requirements. 10 pages.

(Plicoflex, Inc., 5501 Santa Fe Ave., Los Angeles 58, Cal.)
Circle 1543 opposite last page.

"And what's wrong with our lighting?"

### Retractable soot blower has single-motor drive

One motor simultaneously propels and rotates lance tube in new long retracting blowers. Stationary motor mounts at boiler wall for easy accessibility and protection.

Other features, as described in this bulletin, are single set each of motor elements and control elements, poppet valve with adjustable pressures, and cleaning pattern that sweeps every inch.

(Bulletin 2111 is available from Diamond Power Specialty Corp., Lancaster, Ohio.)
Circle 1544 opposite last page.

For more information on items reported in the New Literature section, circle corresponding numbers on reader service card opposite last page.

### Flexible connectors carry gas, fluids

Bulletin gives complete, easy-to-follow price list for bronze heavy-duty flexible connectors for conveying gases, liquids, semi-solids. Specific products such as vibration eliminators, flexible nipples, and pump connectors are classified by size and end fittings to save time in price computation.

Four-page bulletin is designed to eliminate necessity of computing price of every element of an assembly separately.

(Form IK-1 is available from Cobra Metal Hose, 4640 W. 54th St., Chicago 32, Ill.)
Circle 1545 opposite last page.

### Beat heat problems with direct-fired unit heaters

Bulletin describes direct-fired unit heaters for heating office, lab, factory, or warehouse. Suspended, duct, and free-standing models from 25,000 to 2 million Btu.

(Bulletin GN-57 is available from Reznor Manufacturing Co., 70 Union St., Mercer, Pennsylvania.)
Circle 1546 opposite last page.

### Silicone products reference guide

Over 150 silicone products, including new ones introduced within the last year, are described in new 16-page bulletin. Plus features of silicones include resistance to both excessive heat and cold, ability to withstand attack from highly corrosive chemicals, water repellency, resistance to oxidation, weathering, and corona.

Fully indexed bulletin describes silicones for adhesives, compressible fluids, defoamers, electric insulation, lubricants, transducer fluid, and water repellents.

(Reference Guide 1-113 is available from Dow Corning Corp., Midland, Mich.)
Circle 1547 opposite last page.

### Describes accessories for bulk conveyors

Six-page bulletin describes rotary seals and quick-release valves. Seals transmit air, liquid, or gases under pressure or vacuum from stationary source into rotating shaft.

Release valves provide quick evacuation of pressurized air from pneumatic systems. Gives complete technical data on both products.

(Bulletin ML-177 is issued by Fawick Airflex Div., Fawick Corp., 9919 Clinton Rd., Cleveland 11, Ohio.)
Circle 1548 opposite last page.

### Boiler feed pump built to last

Power plant boiler feed pumps are designed for "overstrength" in all components to give long, trouble-free service with minimum maintenance. New seal design eliminates packing problems, scored shafts, lubrication wash-outs. Heavy-duty housing prevents warpage.

New bulletin gives technical data on pump design theory, specifications, dimensions, and capacity ratings.

(Bulletin 65 is available from Fred H. Schaub Engineering Co., 2103 S. Marshall Blvd., Chicago 23, Ill.)
Circle 1549 opposite last page.

### Use-it-again air hose, couplings, fittings

Air hose coupling can be assembled quickly by maintenance crew. Coupling can be used for a variety of hookups or for one permanent hookup. New 8-page bulletin gives complete data on new air hose coupling, industrial vinyl hose, and fittings.

Couplings are available in brass, with stainless steel springs and valves. Plugs are cadmium plated steel or brass, so coupling can be used with water, other corrosive fluids. Capacity is 125 psi.

(Bulletin H-52 is available from Hofmann Engineering Co., 5601 S. Crawford Ave., Chicago 29, Ill.)
Circle 1550 opposite last page.

### Power circuit breakers for 5-cycle interruption

Two new bulletins describe oil-blast interrupters that provide five-cycle interruption with low oil carbonization and reduced contact erosion.

Bulletin GEA-6599 gives details on type FK, 69-kv, power circuit breakers rated 1000, 1500, 2500 mva, 600-1200 amp.

Bulletin GEA-6600 gives details on type FK, 69-kv, rated 3500 and 5000 mva, 2000 amp.

(Both bulletins give test and mechanism data, full dimensions. 8 pages each. General Electric Co., Schenectady 5, N. Y.)
Circle 1551 opposite last page.

### Plastic valves handle corrosive fluids

Illustrated bulletin gives essential engineering data on all-plastic gate valve for conveying corrosive and abrasive liquids in lines that must be chemically free from contamination. Drawings illustrate straight-through no-pressure-drop flow feature and close throttling control.

Valves are made of PVC or styrene copolymer. Caps come in Neoprene, Buna N, and Hypalon. Kel-F Elastomer available on special order. Valves are sized from ½ to 2 inches. Bulletin gives complete valve dimensions, psi and temperature range.

(Bulletin 42.0 is available from Vanton Pump & Equipment Corp., Hillside, N. J.)
Circle 1552 opposite last page.

### Performance tables, data on steam heating coils

Bulletin gives selection data and suggested piping arrangements for heavy-duty steam heating coils for space heating. Data includes performance tables, temperature rise constants chart, air temperature rise graph, final temperatures and condensation rate tables.

(Diagrams in bulletin 1715 give full installation data. 12 pages. Sturtevant Div., Westinghouse Electric Corp., 200 Readville St., Hyde Park, Boston 36, Mass.)
Circle 1553 opposite last page.

### Weather-proof controls for oil heater

Bulletin gives specifications on oil heaters for applications where heating temperatures to 500°F are required but where pressures below 15 lb/sq ft must be maintained.

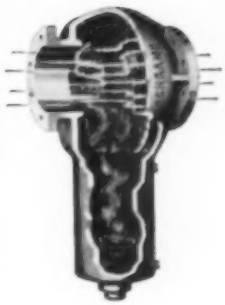
Coil-type furnace design gives positive, controlled oil flow through heating chambers. Entire electric system is weather-proofed. All controls are centralized in weather-proof control box.

(Form RE-363 is available from Bros Inc., 1057 Tenth Ave. S. E., Minneapolis 14, Minn.)
Circle 1554 opposite last page.

### Design criteria report on stacks, breechings

"Report on Design Criteria for Stacks and Breechings" covers sizing, connections, height, stack caps and rain hoods, horizontal breeching, elbow, insulation, draft, and


# Cochrane
## STEAM SPECIALTIES



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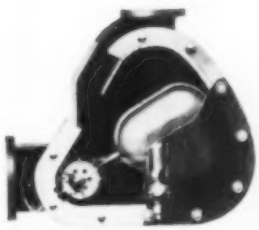

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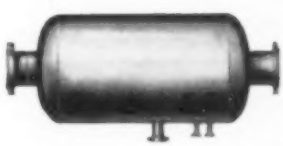

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This single-stage separator device is similar to the Cochrane Separator except that it is designed with an extra-large well to permit cleaned steam storage ahead of engine. Cochrane Receiver Separators help overcome pipeline vibration, enable engines to draw more steadily and efficiently on steam supply. Sizes 3" and up.

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Circle 1555 opposite last page

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*NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.*

Circle 1556 opposite last page



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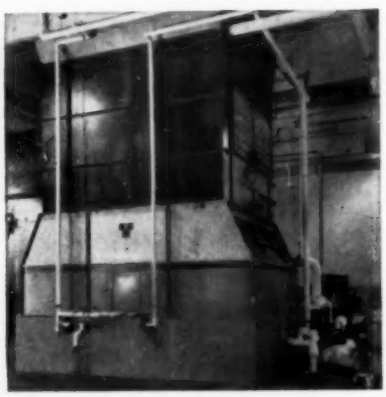

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*Niagara District Engineers in Principal Cities of U. S. and Canada*

Circle 1557 opposite last page


## NEW LITERATURE

fixed barometric dampers.

Charts cover equivalent breeching diameters for battery installations and circular equivalents of rectangular ducts for equal friction and capacity.

(24-page report is issued by Orr & Sembower, Inc., Morgantown Rd., Reading, Pennsylvania.)
Circle 1558 opposite last page.

For more information on items reported in the New Literature section, circle corresponding numbers on reader service card opposite last page.

### Steam trapping — why, when, how

Impulse steam trap gives high thermal efficiency of boiler with low maintenance. Trap has only one moving part—a small stainless steel valve.

At start-up, valve opens wide to discharge air and condensate continuously. After unit is in full production, valve keeps temperatures high and steady. Traps come in four series for varying needs: normal, light, and heavy loads; and extra high pressures.

("The Why and How of Steam Trapping" is available from Yarnall-Waring Co., 100 Mermaid Ave., Philadelphia 18, Pa.)
Circle 1559 opposite last page.

### Covers worm-gear speed reducers

Bulletin includes drawings and specification tables for design data and ratings of standard worm-gear speed reducers from 0.1 to 121 hp.

Application data includes types of reducers, service factors, calculation of overhung load, selection procedure. Forty pages.

(Bulletin J-13 is issued by Hewitt-Robins, Inc., 666 Glenbrook Rd., Stamford, Conn.)
Circle 1560 opposite last page.


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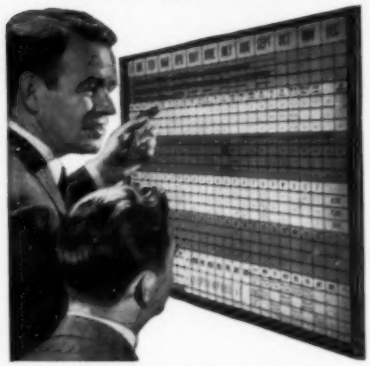

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Circle 1561 opposite last page



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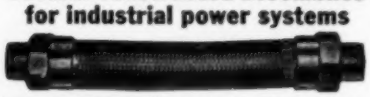

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NEW LITERATURE

### Technical data covers grit collectors

Illustrated bulletin gives design data on seven types of grit collectors, two grit washers, and combination grit collector and mechanical screen.

Designs include velocity controlled chambers for shallow or deep chambers, chambers with dewatering and washing screws or inclined plane dewatering troughs.

Useful information covers selecting chamber length, determining collector efficiency, methods of installation. Tab-indexed bulletin has 28 pages and is punched to fit 3-ring binder.

(Book 2571 is available from Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.)
Circle 1564 opposite last page.

### Underground hot pipe insulation data guide

Bulletin describes underground hot pipe insulation that gives efficient insulation, substantial structural pipe support, high mechanical and load-bearing capabilities, and extreme resistance to water penetration.

(Bulletin Z-1 includes sequence photographs and diagram drawings of this cast-in-place monolithic conduit system. Z-Crete Div., Zonolite Co., 135 S. La Salle St., Chicago 3, Illinois.)
Circle 1565 opposite last page.

### Tells how filter-separator cleans industrial liquids

Data file on 15-gpm filter-separator units gives installation and dimension data, attachment list, and construction details.

Includes checklist of 49 industrial and commercial liquids that can be continuously cleaned by the unit, including diesel fuels, solvents, lube oils, boiler feedwater.

(Four-page Data File is issued by Richmond Engineering Co., 7th & Hospital Sts., Richmond, Va.)
Circle 1566. ◆

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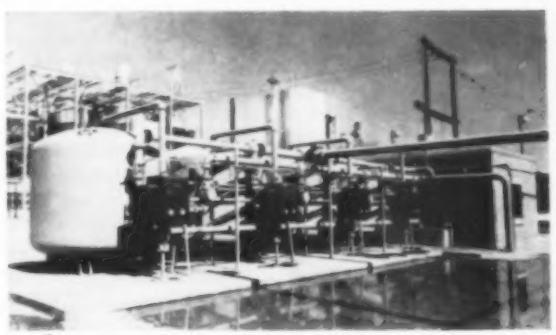

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Circle 1568 opposite last page

## Power Is Slipping Through Our Fingers continued from page 15

ice. By contrast, certain tributaries of the Columbia with a high power potential are heavily involved in the prolonged controversy over fish and big game.

The Pacific Northwest states must depend on electric power for industrial fuel. The region has only minor deposits of coal. Natural gas and petroleum products must be transported from distant sources. The struggle over waterpower development, therefore, is a decisive element in the region's industrial and economic expansion.

Likewise, use of the Yukon which flows into Alaska from Canada, and the St. John which rises in Maine and empties into the Bay of Fundy will have great impact on the economies of these areas. If the web of negotiations can be untangled, the Yukon could produce an eventual 900,000 kw, and the St. John, a total of 567,000 kw.

### Dual Determination Needed

This power involved in the boundary water controversy could be of great economic importance. Yet the necessary formula for sharing benefits and costs has not been forthcoming. Admittedly, there are difficult evaluations involved. Details of engineering plans have not been put into final form. These hurdles might easily be crossed, however, if both governments showed a real determination to resolve the differences.

Much of the present discussion revolves around the extraordinarily complex question of "downstream benefits." These benefits result from upstream storage reservoirs because controlled water releases evens out the flow through penstocks and turbines at downstream dams. In addition, storage reservoirs offer valuable downstream flood control.

Measurement and allocation of these potential benefits involves the most complex evaluation of many factors.

- Estimating of average streamflow
- Time sequence in which future projects will be built
- Total power system development including addition of steam-generated power for decades in the future
- Fundamental economic estimates of future project costs and the value of future power to meet future load growth.

The task is so difficult, even without the complications of international negotiations, that it has long baffled the Federal Power Commission even on rivers wholly within our boundaries. Here, the Federal Power Act requires non-Federal downstream dams to reimburse the United States for benefits from upstream Federal storage reservoirs.

### "Tragic Waste, Loss"

Diffiicult or not, allocations of these costs and benefits must be made. There is no doubt that construction of storage reservoirs on the upper Columbia would create vast power benefits over the length of the whole river. Each month of delay in building these reservoirs constitutes a tragic waste and loss to both Canada and the United States.

Among engineers, there appears to be unanimity that Mica is the key storage project on the upper Columbia, and technical agreement on reservoirs at Libby and the Arrow Lakes seems well within reach. While disagreement over the division of benefits delays a start on these projects, the benefits flow unused to the sea.

Last April, I introduced in the Senate a resolution that offers our State Department a proposal to cut this Gordian knot. In essence, it contemplates that Canada and the United States agree to proceed now with joint planning, and with construction of the major storage reservoirs as fast as engineering plans are ready.

### Precedent Proves Agreement

It suggests that we agree to accept the judgment of a combined agency, with a single expert staff, on the accounting and allocation of costs and benefits of these projects as they are built and added to the total system.

Canada and the U. S. have shown before, in the St. Lawrence Seaway Authority, that they can agree on mutual use of a great water resource they have in common. My proposed North Pacific International Waterways Agency would not build or own dams. Each nation would continue to determine how projects are to be built and owned within its borders.

But on rivers like the Columbia, Kootenai, and Yukon, both countries would agree to submit their potential projects to the overall planning control of the agency. The agency would have responsibility for ensuring that maximum potential benefits of full development are not thrown away in shortsighted and narrowly national plans and policies.

Costs of downstream benefits are not all at upstream sites. Some costs are involved in construction and modification of projects in the U. S. Canadians reasonably want their share of downstream power benefits in the form of power, not cash. Yet, they know that for a while there might be more power than they need. This temporary surplus could be sold in the U. S.

### Why Not Agree Now?

The accounting and allocation of these complex matters, partly dependent on unknown future developments, need not be settled once and for all. That could postpone these already unconscionably delayed projects for all eternity. And construction of a project such as Mica can take a decade after it is started.

I assume we agree that we shall agree some day. Why can we not agree, then, to begin now to build the projects that the engineers say are needed and beneficial?

The occasional slight disappointments which the United States might suffer in a decision of such an agency as I have suggested would be nothing compared with the continuing waste and losses caused by the present stalemate. And the same is surely true of Canada. Why can't we get together? ◆


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## Save Tax Dollars

continued from page 17

**Q** Now, let's talk a little about depreciation. Apportioning the cost of a fixed asset over a future number of years is called "depreciating" the asset. The portion of the cost deducted in any one year is the "depreciation" of the asset for that year. We realize that, as you accountants use the term, "depreciation" bears no necessary relationship to the physical deterioration of an asset.

The amount of the yearly depreciation depends on two factors: First, the number of years over which the cost is to be apportioned; and, second, the method of allocating the cost among the number of years selected (equally, more in the earlier years, or more in the later years).

Now, what determines the first factor — the number of years?

**A** An asset's estimated useful life determines the number of years over which it should be depreciated. Useful life has to be estimated because it is determined at the time the asset is acquired.

The difference between useful and physical life should be emphasized. Our country's technological advances and social values have increased the rate of obsolesence of most assets. The result is that the physical life of most assets considerably exceeds their useful life.

For example, most factory buildings could last 100 years. But management expects technological advancements to make its new factory relatively inefficient within 30 to 50 years, so it selects between 30 to 50 years as the useful life rather than 100 years.

The effect of social values on useful life of equipment is illustrated by the tools, dies and patterns of an auto manufacturer. This expensive equipment is barely broken in before the auto manufacturer is replacing it — the physical life of the tooling is irrelevant in determining over how long a period its cost should be spread.

**Q** Are there guides to help select estimated useful life?

**A** Yes, the Internal Revenue

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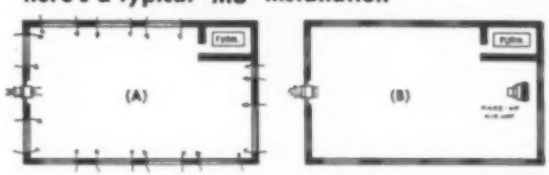


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Service has a list of the probable useful life of several hundred assets. Bulletin F, as it is called, was prepared in 1942, so it is somewhat obsolete itself and is currently under revision.

Another more useful guide is the past experience of both the company and the company's industry. But past experience and Bulletin F are only guides, and for valid reasons, management should select a longer or shorter life.

For example, a relatively short useful life has been justified for a building in one locality because of acid fumes from a nearby chemical plant.

**Q** Could you give us some widely used methods of allocating the cost of an asset over its estimated useful life?

**A** Well, the most obvious method is to allocate the cost equally: This is called the "straight line method." Two other methods that have only recently become widely used are the sum-of-the-digits method and the 200% declining balance method. These were first authorized for income tax by the Internal Revenue Code of 1954 . . . and both result in a greater depreciation in the earlier years.

If you compare these methods (Table 2), you'll find the largest depreciation is obtained by using the 200% declining balance method. By the end of the third year, however, the sum-of-the-digits method has resulted in the largest cumulative depreciation.

The specific year in which the cumulative depreciation under the sum-of-the-digits methods will exceed the 200% declining balance method will vary with the estimated useful life and the salvage value of the asset.

The 200% declining balance method is different from the other two methods in two important respects: First, salvage value is not considered in computing yearly depreciation; and second, an asset never becomes completely depreciated under the 200% declining balance method. A company can switch its method of depreciation from the 200% declining balance to the straight line method, however, without permission from the Internal Revenue Service.

Let me give a word of warning here. The proper depreciation of an asset for income tax purposes requires following certain detailed procedures. Don't try to do-it-yourself — consult an accountant.

A very important advantage of using a depreciation method that provides greater depreciation in the earlier years is that a deferral of income tax results. Another advantage is that while the depreciation deduction is an ordinary deduction, when a fixed asset is sold for more than its unrecovered cost (cost less total depreciation deducted), the gain is taxable at capital gain rates.

**Q** For income tax purposes, then, can the sum-of-the-digits and 200% declining balance methods of depreciation be used for all depreciable assets?

**A** No. These two methods cannot be used for any assets acquired before January 1, 1954. For assets acquired after that date, a company must be the original user of the asset. That is, used equipment (or a previously used building) cannot be depreciated by the sum-of-the digits or 200% declining balance methods.

Used equipment can, however, be depreciated by the 150% declining balance method.

**Q** Mr. Bland, is there any difference in tax treatment in renting as opposed to buying equipment?

**A** If bonafide, rental payments are a deductible expense when the payments are due. Sellers of equipment on a rental basis have pointed out that in the equipment's earlier years, rental payments are greater than the allowable depreciation. They say that a company can, therefore, effect a tax deferral by renting rather than purchasing equipment.

However, with the use of the sum-of-the-digits and the 200% declining balance methods of depreciation (as opposed to straight line), the difference between rental payments and depreciation in the earlier years has been greatly reduced.

Further, the Internal Reve-

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nue Service may question the validity of the rental payments. If certain conditions are present, the Internal Revenue Service may disallow the rental payment deductions and consider the transaction as an installment purchase. Among these conditions are:

- Rental payments of approximately the same amount as would be due on an installment purchase.
- Rental payments due at approximately the same time as installment payments.
- Where equipment becomes the property of the renter at the end of the rental period without an additional substantial payment.

While each case has to be determined separately, the tax advantage to renting as opposed to buying equipment is, in general, much more questionable than it used to be.

**Q** Here's one last question. What are some of the things that might be done to help substantiate treating an expenditure as an expense?

**A** In general, internal revenue field agents are less likely to question a bonafide deduction if it is supported by well-documented records. For example, it is always a good practice to instruct vendors to clearly indicate on their invoices the nature of the goods and services they have rendered.

And don't forget another type of supporting document that might be used for large expenditures. Say, a cement floor needs extensive repairs. Take a photograph of the damaged areas before the repairs are made. This should satisfy the revenue agent as to the necessity for the probably large expense. You just can't afford to trust to memory — record everything you spend. ◆

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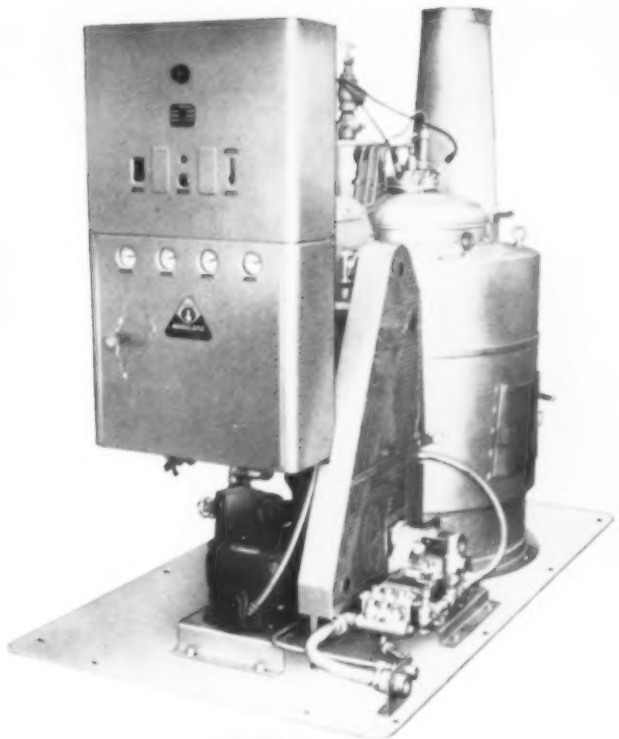

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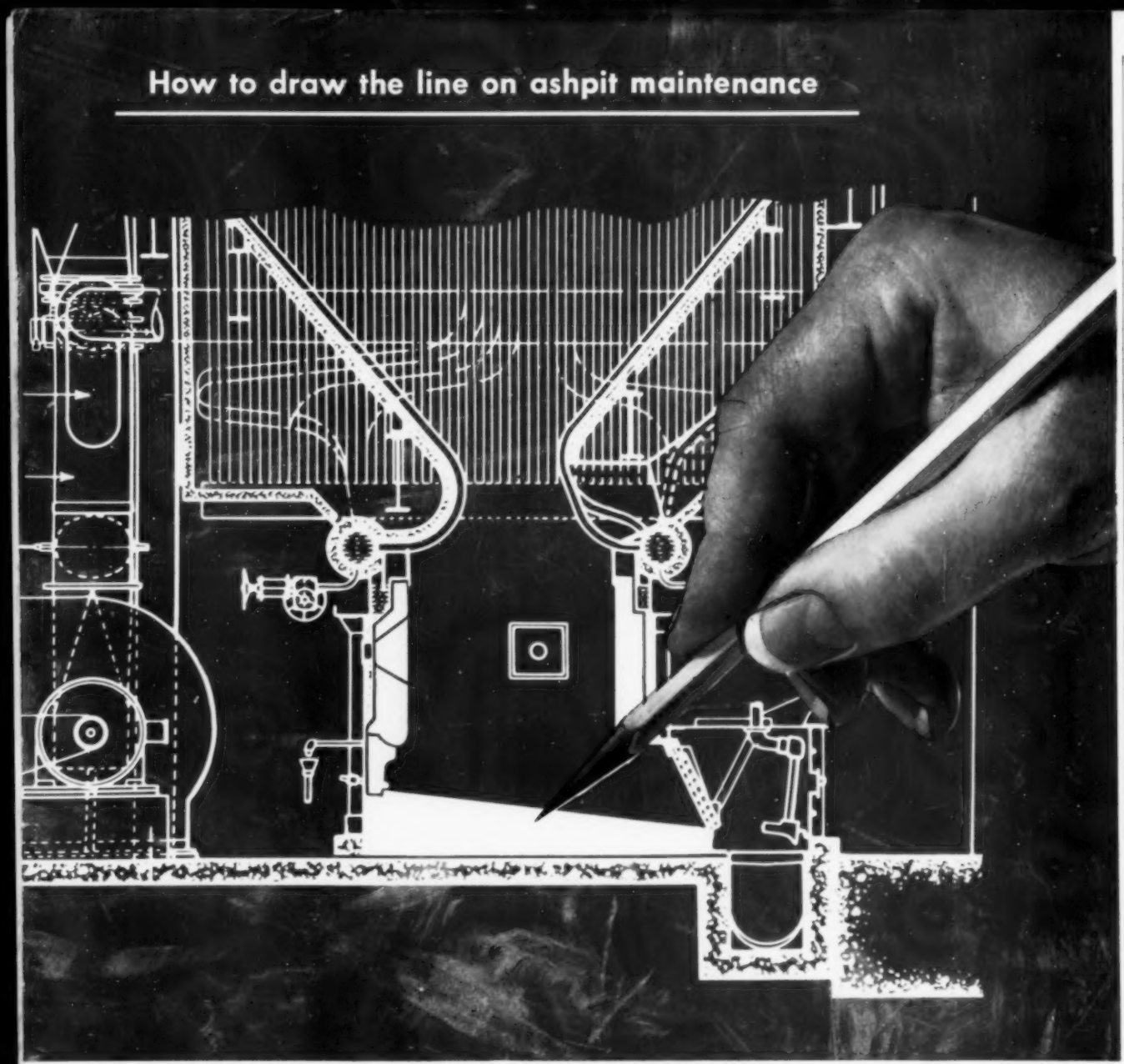

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*Send for Bulletin R-40 which gives data on B&W Kaocrete Refractory Castables for lining ashpits.*

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